FAST BREAK

PUBLICATION FOR TEAM MEDICAL PERSONNEL

RELATIVE ENERGY DEFICIENCY IN SPORT (REDs)

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WELCOME TO FAST BREAK!

Welcome to Fast Break, the official quarterly news bulletin of the FIBA Medical Commission. Our goal is to introduce our FIBA sports medicine and sports science community to newsworthy research topics and develop a community of practice among physicians and clinicians involved with basketball at every level of play across the globe.

We hope this publication will foster friendly communication and discussions within the world of basketball. We welcome and encourage your questions, comments, suggestions, and contributions to this publication.

MESSAGE FROM THE EDITOR

One of the tenets of medicine considers the application of evidence guided practice by the ongoing and ever-changing knowledge that evolves from persistent study. Thirty years ago, we evaluated the Female Athlete Triad: a syndrome of disordered eating leading to amenorrhea and osteoporosis in female athletes. However, the consequences of low energy availability for homeostasis and athletic participation extends to all body systems and impacts female and male athletes alike. Since 2014 the concept of the Female Athlete Triad has been replaced by a more encompassing and inclusive concept of the impact of inadequate fuel for bodily functions and the negative impact that has for athletes. Today we use the term Relative Energy Deficiency in Sport (REDs).

The International Olympic Committee (IOC) published the first consensus statement on RED-S in 2014 and updated in 2018. As more study was made and our understanding of the REDs spectrum of impact has grown, the second international consensus statement from the IOC was published in 2023, along with best practice recommendations for body composition considerations in sport to reduce health and performance risks, and a clinical assessment tool (REDs CAT). While REDs can affect any athlete at any point in training, times of increased intensity and stress may be more vulnerable to low-energy states. With the upcoming Women's Basketball World Cup, monitoring athletes for REDs is an important consideration for the team physician.

This thematic edition of the Fast Break focuses on the physical and mental health impact of Relative Energy Deficiency in Sport. Dr. Anik Shawdon (FIBA Medical Commission) summarizes what you need to know about REDs, and Dr. Marieme Tambedou (Senegal National Women's Basketball Team Physician) highlights an approach to the management of a high-value athlete with a bone stress injury and REDs during a critical competition phase.

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IN THIS ISSUE

EDIFICATION FROM THE MEDICAL COMMISSION

In this segment of the Fast Break, we feature an editorial from a member of the FIBA Medical Commission on topics relevant to basketball.

RELATIVE ENERGY DEFICIENCY in SPORT (REDs)

Dr Anik Shawdon, Sport and Exercise Physician, Melbourne, Australia

What is RED-S

The term Relative Energy Deficiency in Sport (RED-S) was introduced in 2104 by the International Olympic Committee (IOC) and refers to a state in which athletes exposed to low energy (inadvertent or deliberate) can suffer adverse health and performance outcomes. Since that time, there has been a great deal of research and the definitions updated, although the underlying premise remains that inadequate energy intake may lead to suboptimal performance, health and in some cases, wellbeing, with the potential for longer term complications. It is important to note that male athletes can be affected. A working definition, from the 2023 Relative Energy Deficiency in Sport (REDs) IOC Consensus Statement is as follows: The syndrome of REDs refers to impaired physiological function including, but not limited to, metabolic rate, menstrual function, bone health, immunity, protein synthesis, cardiovascular health caused by relative energy deficiency.

Background

Energy availability (EA) refers to the dietary energy left over and available for optimal body function after accounting for the energy expended from exercise. Energy availability (EA) is calculated as energy intake (EI) minus the energy cost of exercise (EEE) relative to fat free mass (FFM) or lean body mass (i.e. EA= EI-EEE/FFM).

Low energy availability (LEA) occurs when there is a mismatch leading to inadequate energy to support the bodily functions that support health and performance. A spectrum exists, of which one end is a relatively benign (adaptable) LEA which can be rapidly corrected without any persistent effects on health, performance or wellbeing. Further along the spectrum, LEA can become clinically problematic with secondary effects on body physiology and the athlete's wellbeing. Prolonged or severe LEA can lead to REDs, a syndrome which comprises a number of clinical effects including, but not limited to, suboptimal musculoskeletal health, impaired immunity/recovery, reproductive system impacts, cardiovascular changes and psychological consequences. These lead to impaired performance, wellbeing and recovery which together will cause a negatively impact on the athlete.

Why do Athletes Develop REDs?

Athletes face unique nutritional challenges, above and beyond those of their less active peers, related to the sporting environment. These can include high, and often variable, training loads, inadequate opportunities to re-fuel (late evening matches or early morning training), trying to meet a weight category (e.g. boxing, combat sport) and travel related challenges (food types, quality, availability). Personal risk factors may include performance pressures, aesthetic expectations, certain personality types or training adjustments following injury. Any of these may contribute to REDs which is often inadvertent but, in some cases, may be related to more serious eating disorders.

Consequences of REDs

Prolonged suboptimal energy availability can have effects on both the health and performance of athletes. Important factors in assessing the potential consequences of LEA and development of REDs include the severity and duration of inadequate energy availability

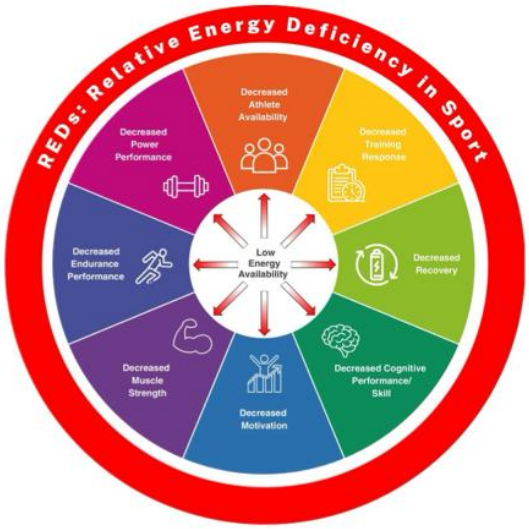
Potential health and performance consequences of REDs, which are numerous and diverse, are outlined in the attached infographics. Some of the health consequences, including bone stress injuries, irregular menstrual irregularities, recurrent illness and mood and sleep changes, may be more commonly identified in athletes where injury and wellbeing reporting may be routine. Performance effects of REDs include suboptimal response to training loads (power, muscle strength and endurance), decreased motivation and reduced recovery

REDs Health Conceptual Model.

Margo Mountjoy et al. Br J Sports Med 2023;57:1073-1098

BJSM

REDs Performance Conceptual Model.



Margo Mountjoy et al. Br J Sports Med 2023;57:1073-1098

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How to Diagnose REDs

The early signs of REDs can be quite subtle and a high index of suspicion is warranted in combination with a thorough history, examination and appropriate investigations, since early intervention has the best chance of preventing long term consequences. In addition to consideration of the diagnosis with any of the presentations below, annual screening for REDs should be considered as a part of the pre-participation health evaluation. The IOC REDs CAT2 has been designed to identify early signs of problematic LEA (see below) and readers are recommended to read this in full.

Symptoms and signs which may suggest REDs include, but are not limited to:

- reduced training and performance results
- recurrent injury (especially bone stress injury) or illness
- menstrual dysfunction/changes (female athletes), or reduced libido
- low iron levels or other haematological changes
- mood changes
- weight loss, change in body composition or failure to response to training interventions
- limited or restricted dietary intake

If any of these are identified, referral to a sports physician/doctor for clinical assessment and investigations is required. This should include assessment of the clinical complaint, as well as a thorough assessment of potential underlying, and possibly more subtle, causative factors.

How to manage REDs

In general, the effects of REDs can be corrected by addressing energy balance through a combination of increased energy intake and modified training loads, dependent upon the specific clinical presentation. If a player is unable or unwilling to comply with a treatment plan comprising greater energy intake or reduced training loads, an underlying psychological component to the presentation should be considered.

Management of an athlete with REDs should always be multidisciplinary and may include team medical staff, or external specialists, including sports physician, sports physiotherapist/physical trainer, sports dietitian, psychologist/psychiatrist (as required) and high performance/exercise physiologist.

In addition to managing the developing or established presentation findings, it is important to try and identify the cause. For example, a basketballer with secondary amenorrhoea and low BMD may be treated with transdermal oestrogen, but it is equally important to address the underlying energy availability issue. Ongoing monitoring of energy availability is recommended throughout the process including once the athlete has returned to full health and performance.

Practical Summary

- REDs can be unintentional or deliberate, and can result, if sustained, in negative effects on athletes health and performance
- REDs is a syndrome and there is no single test or value that is diagnostic. As such, a high index of suspicion is required
- Team physiotherapists are encouraged to note, and refer, if their players are reporting poor sleep or high RPE, have ≥ 1 bone stress injury, have recurrent viral illnesses or demonstrate any other behaviours that might indicate REDs
- Team physicians should note changes to a players menstrual status, unusual requests for medications, subtle signs of disordered eating behaviours or other medical presentations which may reflect underlying REDs

References:

The IOC consensus statement: beyond the Female Athlete Triad—Relative Energy Deficiency in Sport (RED-S) https://bjsm.bmj.com/content/48/7/491; Mountjoy M. et al

Mapping the complexities of Relative Energy Deficiency in Sport (REDs): development of a physiological model by a subgroup of the International Olympic Committee (IOC) Consensus on REDs https://bjsm.bmj.com/content/57/17/1098; Burke L. et al

The IOC REDs CAT2: https://stillmed.olympics.com/media/Documents/Athletes/Medical-Scientific/Consensus-Statements/REDs/IOC-REDs-CAT2.pdf

SELECTED PUBLICATIONS OF INTEREST

The IOC consensus statement: beyond the Female Athlete Triad--Relative Energy Deficiency in Sport (RED-S)

Mountjoy M, Sundgot-Borgen J, Burke L, Carter S, Constantini N, Lebrun C, Meyer N, Sherman R, Steffen K, Budget R, Ljungqvist A. Br J Sports Med. 2014 Apr;48(7):491-7. doi: 10.1136/bjsports-2014-093502.

Protecting the health of the athlete is a goal of the International Olympic Committee (IOC). The IOC convened an expert panel to update the 2005 IOC Consensus Statement on the Female Athlete Triad. This Consensus Statement replaces the previous and provides guidelines to guide risk assessment, treatment and return-to-play decisions. The IOC expert working group introduces a broader, more comprehensive term for the condition previously known as 'Female Athlete Triad'. The term 'Relative Energy Deficiency in Sport' (RED-S), points to the complexity involved and the fact that male athletes are also affected. The syndrome of RED-S refers to impaired physiological function including, but not limited to, metabolic rate, menstrual function, bone health, immunity, protein synthesis, cardiovascular health caused by relative energy deficiency. The cause of this syndrome is energy deficiency relative to the balance between dietary energy intake and energy expenditure required for health and activities of daily living, growth and sporting activities. Psychological consequences can either precede RED-S or be the result of RED-S. The clinical phenomenon is not a 'triad' of the three entities of energy availability, menstrual function and bone health, but rather a syndrome that affects many aspects of physiological function, health and athletic performance. This Consensus Statement also recommends practical clinical models for the management of affected athletes. The 'Sport Risk Assessment and Return to Play Model' categorises the syndrome into three groups and translates these classifications into clinical recommendations.

IOC consensus statement on relative energy deficiency in sport (RED-S): 2018 update

Mountjoy M, Sundgot-Borgen JK, Burke LM, Ackerman KE, Blauwet C, Constantini N, Lebrun C, Lundy B, Melin AK, Meyer NL, Sherman RT, Tendorde AS, Torstveit MK, Budgett R. Br J Sports Med. 2018 Jun;52(11):687-697. doi: 10.1136/bjsports-2018-099193.

2023 International Olympic Committee's (IOC) consensus statement on Relative Energy Deficiency in Sport (REDs)

Mountjoy M, Ackerman KE, Bailey DM, et al. Br J Sports Med, 2024;57:1073–1098.

Relative Energy Deficiency in Sport (REDs) was first introduced in 2014 by the International Olympic Committee's expert writing panel, identifying a syndrome of deleterious health and performance outcomes experienced by female and male athletes exposed to low energy availability (LEA; inadequate energy intake in relation to exercise energy expenditure). Since the 2018 REDs consensus, there have been >170 original research publications advancing the field of REDs science, including emerging data demonstrating the growing role of low carbohydrate availability, further evidence of the interplay between mental health and REDs and more data elucidating the impact of LEA in males. Our knowledge of REDs signs and symptoms has resulted in updated Health and Performance Conceptual Models and the development of a novel Physiological Model. This Physiological Model is designed to demonstrate the complexity of either problematic or adaptable LEA exposure, coupled with individual moderating factors, leading to changes in health and performance outcomes. Guidelines for safe and effective body composition assessment to help prevent REDs are also outlined. A new REDs Clinical Assessment Tool-Version 2 is introduced to facilitate the detection and clinical diagnosis of REDs based on accumulated severity and risk stratification, with associated training and competition recommendations. Prevention and

treatment principles of REDs are presented to encourage best practices for sports organizations and clinicians. Finally, methodological best practices for REDs research are outlined to stimulate future high-quality research to address important knowledge gaps.

Scientific Utility of Emerging Indicators in Relative Energy Deficiency in Sport (REDs) Severity/Risk Assessment.

Heikura IA, Tsai MC, Burke LM, Ackerman KE, Forsyth S, Hackney AC, Stellingwerff T. Scandinavian Journal of Medicine & Science in Sports. 36(7):e70318, 2026 Jul.

Many emerging but non-validated indicators and biomarker thresholds have been used in the Relative Energy Deficiency in Sport (REDs) literature. Accordingly, we (1) compared the outcomes of the 2023 International Olympic Committee REDs Clinical Assessment Tool-version 2 (CAT2) (green, yellow, orange and red traffic light risk/severity assessment) with emerging REDs indicators, and (2) tested the utility of existing risk thresholds (clinical vs. subclinical biomarker cut-offs) for primary and secondary REDs indicators. Female (n = 143) and male (n = 70) athletes (performance tier 3-5) were assessed with the CAT2 and emerging REDs indicators featuring a self-report questionnaire, fasted blood analysis, resting blood pressure (BP) and heart rate (HR). Logistic regression was used to determine threshold cut-offs for blood biomarkers at which there was an 80% probability of REDs. Red-light athletes had significantly lower systolic BP ($p < 0.001$), HR ($p = 0.009$), white blood cell count (WBC; $p = 0.018$) and higher high-density lipoprotein cholesterol ($p = 0.028$) compared to green-light. Elevated cortisol: insulin ratio ($p = 0.018$), and reduced prolactin ($p < 0.001$) and luteinizing hormone ($p < 0.05$) concentrations were observed among higher-risk (orange + red) versus lower-risk (green + yellow) athletes. Males with total testosterone and triiodothyronine within the lowest quartile of reference range had an 80% probability of being classified as higher risk (orange + red) and history of BSI, respectively. For other outcomes at 80% probability, biomarkers were outside the clinical range. HR, systolic BP and WBC may be appropriate considerations for extreme (red-light) REDs diagnosis. More research with larger numbers of orange/red

light athletes is needed to confirm findings and elucidate athlete-specific cut-offs for subclinically low biomarkers.

Low Energy Availability and Its Impact on Bone Health and Metabolism in Athletes: A Narrative Review.

Konvicka J, Kanova M, Borzenko N, Petrekova K, Buzga M. Physiological Research. 74(Suppl 1):S19-S35, 2025 Dec 31.

Low energy availability (LEA) is a recognized risk factor that affects the health and performance of athletes. This narrative review summarizes current evidence on the relationship between LEA, resting metabolic rate (RMR), and bone mineral density (BMD). It focuses on the applicability of the RMR ratio as an indicator of metabolic adaptation to energy deficiency and analyzes the associations between energy availability and skeletal health outcomes. This narrative review demonstrates that reduced energy availability is related to a decrease in the RMR ratio and hormonal alterations characteristic of Relative Energy Deficiency in Sport (RED-S). Furthermore, prolonged LEA has been associated with impairments in bone metabolism and lower Z-scores, particularly among endurance and aesthetic athletes. However, the findings also suggest that the impact of LEA on BMD may be modulated by sport-specific loading patterns and additional individual factors. Considerable methodological heterogeneity between studies limits the direct comparability of the results, highlighting the need for standardization in the evaluation of EA, RMR, and BMD. This review emphasizes the importance of comprehensive screening strategies combining nutritional, metabolic, hormonal, and skeletal markers for early identification of the risk of RED-S. Future research should prioritize longitudinal designs to better understand the dynamics of metabolic and skeletal changes in response to fluctuations in energy availability.

The association between the risk of relative energy deficiency in sports and performance outcomes: A real-world examination of international elite volleyball male athletes.

Sesbreno E, Dziedzic C, Blondin DP, Kennedy C, Sygo J, Haman F, Deslauriers J, Brazeau AS, Mountjoy M. Journal of Sports Sciences. 43(16):1665-1674, 2025 Aug.

BACKGROUND: Relative Energy Deficiency in Sports (REDs) has been reported in Olympic-level male athletes, but the impacts of REDs on performance is unclear. This study explored the association between international elite level volleyball male athletes at risk of REDs and countermovement jump (CMJ) and cognitive performance in real-world setting. METHODS: Using a cross-sectional design, 22 male athletes from a national indoor volleyball program were assessed for medical history, resting metabolic rate, dual energy x-ray absorptiometry assessment of body composition, hematological analysis, 4-day dietary intake, restrained eating behaviour via three-factor eating questionnaire - R18, Victorian Institute of Sport Assessment questionnaire - patellar tendon, CMJ and cognitive performance with the Stroop test. Being at risk of REDs was associated with poorer jump performance (mean power, velocity and jump height) and not Stroop test outcomes ($p <= 0.05$). RESULTS: Being at risk of REDs was associated with poorer jump performance (mean power, velocity and jump height) and not Stroop test outcomes ($p <= 0.05$). CONCLUSION: Future work should characterize the effects of REDs on neuromuscular performance in international elite level team-based male athletes.

Barriers and enablers to measuring resting metabolic rate in the high-performance sporting system: A qualitative exploratory study.

Kuikman MA, McKay AK, Brown H, Townsend N, McCormick R, Morabito A, Pichshev N, Slater G, Burke LM. Journal of Sports Sciences. 43(3):280-288, 2025 Feb.

Measurements of resting metabolic rate (RMR) may be undertaken for dietary planning purposes or to assess for low energy availability (LEA). This study investigated barriers and enablers to measuring RMR in real-world, high-performance sport environments. Twelve interviews were conducted with technicians (n = 6 dietitians, n = 6 physiologists) employed across six National Institute Networks, two National Sporting Organisations and one professional sporting code. RMR was predominantly measured to screen for LEA with measurements only occurring in a few instances for dietary planning purposes. Data was thematically analysed with six main themes identified. Barriers included lack of confidence in measuring RMR, burden of measurement on athlete and technician, confusion over measurement responsibility, and scepticism in RMR measurements as an indicator of LEA. Subthemes that contributed to scepticism included: the RMR thresholds used to indicate LEA, unanswered research questions, and measurement errors introduced by athlete presentation, testing equipment and/or environment. Enablers to use of RMR measurements included perceived value of RMR measurements as a 'piece of the puzzle' when assessing for LEA and its use as a longitudinal measure. Best practice guidelines for RMR measurements in athletic cohorts must consider these barriers and enablers as they highlight unique characteristics of athletes and their environment.

Current Resting Metabolic Rate Prediction Equations Lack Sensitivity and Specificity to Indicate Relative Energy Deficiency in Sport: A Large Cohort Study in Elite Athletes.

Heikura IA, Tsai MC, Sesbreno E, McCluskey WTP, Johnson L, Murray H, Stellingwerff T. International Journal of Sport Nutrition & Exercise Metabolism. 35(4):324-336, 2025 Jul 01.

OBJECTIVES: Measured resting metabolic rate (RMR) was compared to predicted RMR equations (RMRratio) to see whether a low RMRratio relates to the Relative Energy Deficiency in Sport (REDs) Clinical Assessment Tool 2 (CAT2) severity/risk score. METHODS: Female (n = 127) and male (n = 53) athletes (performance Tiers 3-5) were assigned green/yellow/orange/red light according to CAT2. RMR and submaximal exercise energy expenditure (via cycle ergometer) were assessed fasted on the same morning via indirect calorimetry. Low RMR was defined as RMRratio < 0.90, with 11 RMR prediction equations tested for sensitivity, specificity, and predictive validity against the CAT2. RESULTS: RMRratio (Cunningham) was only lower in red versus green light (0.90 +/- 0.07 vs. 0.99 +/- 0.10; p = .023; but RMRratio was only low in 44% of red light athletes). The prevalence of low RMRratio ranged from 1% (Owen equation) to 68% (van Hooren equation) despite the overall prevalence of REDs being 46%. As a diagnostic (no REDs [green] vs. REDs [yellow + orange + red]), Cunningham equation reported sensitivity (true positives) of 0.77 at RMRratio of 1.00 and specificity (true negatives) of 1.00 at RMRratio of 0.70. Exercise energy expenditure was significantly lower in green versus orange (0.131 +/- 0.013 vs. 0.142 +/- 0.008 kcal.kg fat-free mass-1.min-1; p < .001) but was greater in red (0.127 +/- 0.011) versus orange. CONCLUSION: Interpretation of RMRratio is radically impacted by choice of prediction equation. Although there may be some utility in cross-sectionally detecting extreme REDs cases (red light) via RMRratio, more research with a focus on sport/phenotype-specific prediction equations and varying risk thresholds is required to strengthen the validity and reliability of RMR as a part of REDs diagnostics.

Risk of Low Energy Availability in National and International Level Paralympic Athletes: An Exploratory Investigation.

Pritchett K, DiFolco A, Glasgow S, Pritchett R, Williams K, Stellingwerff T, Roney P, Scaroni S, Broad E. Nutrients. 13(3), 2021 Mar 18.

Background: The purpose of this study was to examine the symptoms of low energy availability (LEA) and risk of relative energy deficiency in sport (RED-S) symptoms in para-athletes using a multi-parameter approach. Methods: National level para-athletes (n = 9 males, n = 9 females) completed 7-day food and activity logs to quantify energy availability (EA), the LEA in Females Questionnaire (LEAF-Q), dual energy X-ray absorptiometry (DXA) scans to assess bone mineral density (BMD), and hormonal blood spot testing. Results: Based on EA calculations, no athlete was at risk for LEA (females < 30 kcal.kg-1 FFM.day-1; and males < 25 kcal.kg-1 FFM.day-1; thresholds for able-bodied (AB) subjects). Overall, 78% of females were "at risk" for LEA using the LEAF-Q, and 67% reported birth control use, with three of these participants reporting menstrual dysfunction. BMD was clinically low in the hip (<-2 z-score) for 56% of female and 25% of male athletes Conclusions: Based on calculated EA, the risk for RED-S appears to be low, but hormonal outcomes suggest that RED-S risk is high in this para-athlete population. This considerable discrepancy in various EA and RED-S assessment tools suggests the need for further investigation to determine the true prevalence of RED-S in para-athlete populations.

Reproductive Health Management of Female Adolescent Athletes With Relative-Energy Deficiency in Sport.

Romano ME, Sass A. Journal of Pediatric & Adolescent Gynecology. 38(2):108-116, 2025 Apr.

The objective of this document is to guide the screening, diagnosis, and management of Relative Energy Deficiency in Sport (RED-S) in Adolescent/Young Adult (AYA) athletes to treat symptoms and reduce long-term sequelae with a focus on gynecologic aspects of the disorder. RED-S is a more comprehensive term for the condition previously known as the Female Athlete Triad. An overview of the clinical presentation, evaluation, and management of the reproductive health aspects of RED-S for female athletes is provided. For the purposes of this document, "female" refers to those designated female at birth, and "athlete" is defined as an individual who participates in regular physical activity. This document is intended for use by healthcare providers who care for female athletes with RED-S.

Identifying and Analyzing Low Energy Availability in Athletes: The Role of Biomarkers and Red Blood Cell Turnover.

Suzuki D, Suzuki Y. Nutrients. 16(14), 2024 Jul 15.

Low energy availability (LEA) is a growing concern that can lead to several problems for athletes. However, adaptation to LEA occurs to maintain balance over time, making diagnosis difficult. In this review, we categorize LEA into two phases: the initial phase leading to adaptation and the phase in which adaptation is achieved and maintained. We review the influence of LEA on sports performance and health and discuss biomarkers for diagnosing LEA in each phase. This review also proposes future research topics for

diagnosing LEA, with an emphasis on the recently discovered association between red blood cell turnover and LEA.

Metabolic Workup for Bone Stress Injury: A Practical Approach for Evaluating Bone Health in Athletes.

Nye NS, Kasper K, Hoang TD, Gee S, McClung JP, Crutchfield A, Childress M, Tenforde AS, Boden B

Sports & Health. 18(3):521-533, 2026

CONTEXT: This review synthesizes current literature regarding metabolic aspects of athlete bone health and incorporates evidence-based recommendations into a clinician-friendly algorithm. EVIDENCE ACQUISITION: Published manuscripts listed in PubMed between 1993 and 2024 were reviewed. Relevant terms including keywords and section titles of manuscripts were searched, and relevant studies identified. STUDY DESIGN: Clinical review. LEVEL OF EVIDENCE: Level 1-3. RESULTS: A metabolic workup is often appropriate in the context of an athlete with bone stress injury (BSI) but varies based on clinical scenario. Evidence supports that all athletes with BSI be considered for a minimum workup including 25-hydroxyvitamin D (SORT A), complete blood count (CBC) (SORT B), and an iron panel with ferritin (SORT B). Athletes with features of low energy availability, including >=2 Triad risk factors (low body mass index, abnormal uterine bleeding), or with multiple features of relative energy deficiency in sport require an initial strategy to correct energy availability (increased energy intake and/or decreased training load) and should be considered for dual-energy x-ray absorptiometry (DXA) (SORT A) and additional laboratory testing. If there is persistent clinical concern, a comprehensive laboratory evaluation should be considered, and varies based on athlete sex and clinical context. People with recurrent or multiple BSI or requiring surgical fixation also warrant detailed, stepwise testing for underlying causes (SORT C). A reasonable strategy starts with a focused workup for more common conditions (eg, CBC, complete metabolic panel, iron panel, 25-OH vitamin D, DXA) and may expand based on initial findings and clinical suspicion. CONCLUSION: Existing evidence supports optimizing nutrition and further evaluation for factors influencing bone health for all athletes with BSI. More extensive workup is required in athletes with multiple features of low energy availability, multiple/recurrent BSI, BSI requiring surgical fixation, and signs/symptoms of an underlying medical disorder.

Impact of Relative Energy Deficiency in Sport (REDs) on Bone Health in Elite Athletes: A Retrospective Analysis.

von Brackel FN, Munzinger R, Bartosik M, Simon A, Barvencik F, Oheim R, Amling M Journal of Cachexia, Sarcopenia and Muscle. 16(5):e70082, 2025 10.

BACKGROUND: Relative energy deficiency in sport (REDs) is associated with impaired performance and compromised bone health in elite athletes. While reduced bone mineral density (BMD) and increased risk for bone stress injuries are well documented, the underlying metabolic mechanisms remain poorly understood. This study investigates the bone metabolism in athletes with REDs and its impact on BMD and bone microstructure. METHODS: We retrospectively analysed data from 82 elite athletes (30.5% females, age 23.4 +/- 7.6 years) who presented to our outpatient clinic. The diagnosis of REDs was made according to the International Olympic Committee REDs Clinical Assessment Tool Version 2 (IOC REDs CAT2), and athletes were categorised into strength-based vs. endurance-based sports. Laboratory assessment of calcium and bone metabolism included bone turnover markers such as osteocalcin, procollagen type 1 N-terminal propeptide (P1NP) and urinary deoxypyridinoline (DPD). Areal BMD with corresponding Z-score

was measured by dual-energy X-ray absorptiometry (DXA) at the lumbar spine and hip. Volumetric BMD and bone microstructure were assessed by high-resolution peripheral quantitative computed tomography (HR-pQCT) at the distal radius and tibia. RESULTS: REDs was diagnosed in 24% of the athletes, and stress fractures were observed more frequently in athletes with REDs compared with those without REDs (70% vs. 25%, $p < 0.001$). Athletes with REDs showed significantly lower haemoglobin and haematocrit levels ($p < 0.05$). Osteocalcin and P1NP were reduced in REDs compared with athletes of strength-based disciplines ($p < 0.01$), while urinary DPD/creatinine and calcium excretion were elevated ($p < 0.05$), indicating suppressed bone formation and increased bone resorption, respectively. Athletes with REDs exhibited significantly reduced Z-scores at the lumbar spine and hip compared with strength and endurance athletes without REDs ($p < 0.05$). HR-pQCT revealed significantly lower bone volume to tissue volume and trabecular BMD at the distal radius and tibia, with more pronounced effects at the load-bearing tibia ($p < 0.01$). Similarly, trabecular number and cortical thickness were reduced in REDs, while no differences were observed in trabecular thickness. CONCLUSION: Athletes with REDs are characterised by a catabolic bone metabolism, marked by reduced bone formation alongside increased bone resorption. The resulting metabolic imbalance compromises skeletal adaptations to mechanical loading and contributes to decreased BMD and deteriorated bone microstructure, particularly at weight-bearing sites. These findings underscore the shared key features of REDs and cachexia and highlight the need for early identification and management of REDs to prevent bone stress injuries and preserve athletic performance. Monitoring bone metabolism may support targeted treatment and improve outcomes in affected athletes.

Relative Energy Deficiency in Sport (REDs): Endocrine Manifestations, Pathophysiology and Treatments.

Angelidi AM, Stefanakis K, Chou SH, Valenzuela-Vallejo L, Dipla K, Boutari C, Ntoskas K, Tokmakidis P, Kokkinos A, Goulis DG, Papadaki HA, Mantzoros CS Endocrine Reviews. 45(5):676-708, 2024 09 12.

Research on lean, energy-deficient athletic and military cohorts has broadened the concept of the Female Athlete Triad into the Relative Energy Deficiency in Sport (REDs) syndrome. REDs represents a spectrum of abnormalities induced by low energy availability (LEA), which serves as the underlying cause of all symptoms described within the REDs concept, affecting exercising populations of either biological sex. Both short- and long-term LEA, in conjunction with other moderating factors, may produce a multitude of maladaptive changes that impair various physiological systems and adversely affect health, well-being, and sport performance. Consequently, the comprehensive definition of REDs encompasses a broad spectrum of physiological sequelae and adverse clinical outcomes related to LEA, such as neuroendocrine, bone, immune, and hematological effects, ultimately resulting in compromised health and performance. In this review, we discuss the pathophysiology of REDs and associated disorders. We briefly examine current treatment recommendations for REDs, primarily focusing on nonpharmacological, behavioral, and lifestyle modifications that target its underlying cause-energy deficit. We also discuss treatment approaches aimed at managing symptoms, such as menstrual dysfunction and bone stress injuries, and explore potential novel treatments that target the underlying physiology, emphasizing the roles of leptin and the activin-follistatin-inhibin axis, the roles of which remain to be fully elucidated, in the pathophysiology and management of REDs. In the near future, novel therapies leveraging our emerging understanding of molecules and physiological axes underlying energy availability or lack thereof may restore LEA-related abnormalities, thus preventing and/or treating REDs-related health complications, such as stress fractures, and improving performance.

Relative Energy Deficiency in Sport-Multidisciplinary Treatment in Clinical Practice.

Meyer A, Haigis D, Klos B, Zipfel S, Resmark G, Rall K, Dreser K, Hagmann D, Nies A, Kopp C, Mack I. Nutrients. 17(2), 2025 Jan 09.

BACKGROUND/OBJECTIVES: The primary aim of this study was to characterize athletes approaching an outpatient interdisciplinary and multidisciplinary consultation structure for athletes with a suspected relative energy deficiency in sport (REDs) cross-sectionally and longitudinally to prove treatment efficacy. METHODS: Data of 58 athletes suspected of REDs were collected at the onset (t0) and completion (t1) of interdisciplinary and multidisciplinary REDs treatment (clinical practice) between January 2019 and December 2022. The data included extracted information from medical records, anthropometric characteristics, physical performance diagnostics, laboratory values, dietary records, and partially gynecological and psychosomatic diagnostics. RESULTS: The sample primarily consisted of female athletes (97%) under 18 years of age (66%) who were underweight with a body mass index (BMI) < 18.5 kg/m2 and BMI percentile below the 10th percentile for their age and gender-specific norms (59%), and experienced menstrual disorders (93%). The dietary behavior is characterized by plant-based and low-energy-dense foods. Eating disorders (anorexia nervosa and bulimia nervosa) were diagnosed in 40% of the athletes according to the International Statistical Classification of Diseases and Related Health Problems 11th revision criteria. During the program, 64% of the athletes exhibited a mean weight gain of 7 (+/-6) kg ($p < 0.001$), excluding those still undergoing treatment (36%). CONCLUSIONS: The proposed interdisciplinary and multidisciplinary treatment approach proved effective and holds promise for future evidence-based developments in REDs treatment.

Stigmatised health topics in sport: An action research approach to enhance knowledge and communication.

Hook M, Knight CJ, McGawley K. Journal of Sports Sciences. 44(5):574-592, 2026 Mar.

Performance development among adolescent athletes is influenced by various factors besides physical training and recovery, such as mental health, energy availability and hormonal symptoms and dysfunction. Despite the frequency with which these health-related challenges occur in athletes, they are often stigmatised topics of discussion. The current study aimed to design, implement, and evaluate an educational intervention to foster knowledge-sharing and communication about stigmatised health topics among late adolescent athletes (i.e. 16-19 years old) and their coaches. An action research methodology was adopted. Twenty-one athletes (12 female, nine male) and four coaches (two female, two male) engaged in two initial group sessions to develop the educational intervention (the planning phase). The planned intervention comprised a series of workshops exploring 1. relative energy deficiency in sport (REDs), low energy availability (LEA) and eating disorders (EDs), 2. mental health (MH) and 3. female and male sex hormone function. Evaluation utilised pre- and post-questionnaires and small group discussions. The intervention facilitated communication between the athletes and coaches by enhancing knowledge through integrated knowledge delivery and shared experiences. However, despite completing this educational intervention, the athletes continued to find communication about their body weight, EDs, and male hormone function challenging, which needs further evaluation.

Short-Term Severe Low Energy Availability in Athletes: Molecular Mechanisms, Endocrine Responses, and Performance Outcomes-A Narrative Review.

Jeppesen JS, Hellsten Y, Melin AK, Hansen M. Scandinavian Journal of Medicine & Science in Sports. 35(6):e70089, 2025 Jun.

Many athletes and coaches believe that reducing body mass can improve the power-to-body mass ratio and improve exercise performance. This narrative review aims to characterize the effects of short-term (days to weeks) severe (< 30 kcal/kg Fat Free Mass/day) low energy availability (LEA) on exercise performance and physiological parameters related to health and training adaptations in female athletes. The latter is based on the prevalence of LEA being higher among female athletes, and most of the research is conducted on this population. In addition, we briefly address emerging evidence on short-term severe LEA in male athletes to highlight potential sex differences in physiological responses and performance outcomes. Short-term severe LEA triggers energy-conserving responses, leading to disruption in several crucial physiological systems, including suppression of the hypothalamic-pituitary-ovarian axis, decrease in triiodothyronine and insulin-like growth factor I hormones, reduction in resting metabolic rate, and comprised protein turnover in collagen-rich tissues. If these detrimental effects of short-term severe LEA are not reversed, they can progress to long-term problematic LEA, resulting in hypothalamic amenorrhea, lowering of bone mineral density, increased injury risk, and impaired exercise performance. Recent studies further underscore the detrimental impact of short-term severe LEA in female athletes, revealing suppressed muscle protein synthesis, increased cortisol levels, altered immune function, enhanced fat utilization during exercise, and direct impairments in power, sprinting, and endurance exercise performances despite reductions in body mass. These findings highlight the concerns about the trade-offs between short-term severe LEA for body mass reduction and the ability to maintain optimal physiological function for exercise performance. Further, they challenge the widespread assumption that body mass reduction always improves exercise performance, emphasizing a need for case-by-case considerations within the sporting environment.

A selection of clinical screening tools to help assess for RED-S:

RST (RED-S Specific Screening Tool)
https://assets.cureus.com/uploads/original_article/pdf/30734/1612430181-1612430175-20210204-18268-i9k6n7.pdf

LEAF-Q (Low Energy Availability in Females Questionnaire)
https://bjsm.bmj.com/content/bjsports/suppl/2014/02/21/bjsports-2013 093240.DC1/bjsports-2013-093240supp1.pdf

LEAF-Q Scoring Guide:
https://bjsm.bmj.com/content/bjsports/suppl/2014/02/21/bjsports-2013-093240.DC1/bjsports-2013-093240supp2.pdf

LEAM-Q (Low Energy Availability in Males Questionnaire)
https://www.mdpi.com/2072-6643/14/9/1873

SEAQ-I (Sport-Specific Energy Availability Questionnaire and Interview)
https://bmjopensem.bmj.com/content/4/1/e000424

EDE-Q (Eating Disorder Examination Questionnaire)

https://socialwork.buffalo.edu/content/dam/socialwork/continuing-education/documents/Eating-Questionairre-EDE-Q.pdf

SCOFF (Sick, Control, One (stone), Fat, and Food Questionnaire)
https://www.nutritionhealth.com.au/site/assets/files/1064/scoff-questionnaire.pdf

EAI (Exercise Addiction Inventory)
https://doi.org/10.1080/16066350310001637363

EDS (Exercise Dependence Scale)
https://www.personal.psu.edu/dsd11/EDS/EDS21Manual.pdf

GUEST EDITORIAL

The Team Physician's Role in the Assessment and Management of Relative Energy Deficiency in Sport (REDs)-Related Injuries:
A Clinical Case in a National Team Setting

Dr Tambédou Marième D.
Sport Medicine Physician, Senegal Women's National Basketball Team

Relative Energy Deficiency in Sport (REDs) represents a complex syndrome that affects numerous physiological functions in athletes1. Intervention studies on long-term energy restriction and athletic performance are lacking2. Energy availability (EA) is the difference between total daily energy intake (EI) and exercise energy expenditure (EEE), relative to fat-free mass (FFM)4 (i.e., EA = EI - EEE / FFM). Although EA is typically calculated over a 24-hour period, there has been growing interest in within-day energy deficits that can occur when exercise periods and eating occasions are dissociated, as in "backloading" early-morning exercise combined with the bulk of caloric intake in the evening5.

Energy and substrate requirements are higher during physical preparation and matches, and more moderate during the in-season period in team sports such as basketball6. Persistent low energy availability (LEA) can impair athletic performance through various indirect mechanisms, including impaired recovery leading to a premature decline in physical and mental capacity, as well as impaired optimal muscle mass and function2. Chronic LEA directly impairs bone remodeling and mineral density, exposing athletes to an increased risk of stress fractures and injury recurrence3.

During intense international competition phases, national team athletes' training load peaks and if combined with low energy availability (LEA), can severely compromise bone health and tissue-repair capacity. Stress fractures are a common overuse injury among elite basketball players. This clinical example aims to illustrate how institutional medical follow-up and targeted clinical intervention allow REDs-related injuries to be managed promptly within a national team.

Case Presentation: An elite national team player experienced a left tibial stress fracture in January 2026. She also underwent arthroscopy of the right knee on January 31, 2026, for a partial lateral menisectomy. Confirmation of bony union had not been determined prior to her return to the competitive pressures of the FIBA Women's World Cup qualifying matches in Puerto Rico, March 11-17, 2026. During that event she presented with an acute increase in left tibial bone pain and the new onset of right patellar tendon pain. Worsening symptoms led to sufficient functional impairment as to require withdrawal from competition. Radiographic assessment reconfirmed the stress fracture of the anterior cortex of the left tibial diaphysis with inflammation to the regional soft tissue; there were no associated systemic complication.

Management and Outcome: A multidisciplinary management approach was implemented: strict impact-free rest and analgesia were instituted, followed by an orthopedic consultation with the recommendation for stabilization of the left tibia via locked intramedullary nail. This was performed on April 14, 2026, to prevent a completed fracture. The athlete was allowed a progressive return to weight-bearing. An autologous platelet-rich plasma (PRP) injection was performed to the right knee on May 15, 2026, to stimulate patellar tendon healing, followed by strict adjustment of training load and targeted rehabilitation. The athlete's energy availability was determined to be moderately impaired, but there were no other systemic features of REDs. Energy balance was restored over a 10-week period utilizing structured nutritional guidance. This approach multidisciplinary approach to care resulted in bony union and the athlete's full return to sport.

Conclusion: This case illustrates how integrating a multidisciplinary care approach combining regenerative orthobiologic therapies (PRP), aggressive surgical and biomechanical management, and REDs prevention strategies, together with careful training-load management, enabled this team physician to successfully manage an overuse bone stress injury in a high-stakes international competition setting.

To protect athletes ahead of the FIBA Women's Basketball World Cup 2026, we implemented a targeted prevention strategy built around the following areas:

- Regular monitoring of training load and early screening for stress fractures: monitoring the acute:chronic workload ratio and daily localized bone-pain scores to detect microtrauma before clinical manifestation7,8.
- Systematic assessment of energy availability and bone status: regular REDs screening (validated questionnaires, menstrual tracking, bone densitometry when indicated) for at-risk players, particularly those with a history of stress fracture, with formal confirmation of healing before any return to competition.
- Clear orthobiologic and surgical protocols: standardized indications for regenerative therapies (i.e. PRP) and for surgical decision-making in cases of stress fracture at risk of complication, with logistical planning anticipated from the competition phase abroad.

This case highlights the need for team physicians to consider a multidisciplinary approach when REDs affects athlete health and threatens participation. Stress fractures are rarely isolated biomechanical events; they can occur against a background of chronic energy deficiency, where bone resorption exceeds formation capacity, exposing athletes to prolonged risk, dramatic treatment needs, and potential associated complications.

Note: the case has been anonymized.

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FROM THE HISTORY BOOK

The Patrick Baumann House of Basketball in Mies, Switzerland, opened in 2013. The unique architecture represents a hand and basketball net. Inside are office and conference spaces, a library and a 1000 square meter museum with 40,000 items of intertest that outline the history and evolution of basketball. Outside, on the court, FIBA hosts the annual Open 3x3 tournament welcoming more than 300 teams and over 4000 visitors each year.

(photo FIBA website)

FIBA CLEAN GAME

This recurring segment of the Fast Break will feature important information and updates about anti-doping in basketball. For more information on anti-doping, visit **FIBA Anti-doping**.

SPIRONOLACTONE

While physicians working in sport are aware of anti-doping rules, many of our colleagues in other fields of medicine are totally unaware that a medication they may prescribe for an athlete is banned in sport.

Spironolactone is a common medication prescribed by dermatologists for the management of acne. It works by blocking testosterone effect on skin receptors to decrease sebum production; this in turn prevents the glands in the skin from plugging up with oil and dead skin cells and hinders the *Cutibacterium acnes* bacteria that causes acne. Younger athletes – those competing at a level that is not subjected to doping controls – may be more likely to be medicated for acne management than the adult aged athlete. However, when an athlete moves up in the competitive game and becomes subject to anti-doping in sport, the use of spironolactone may pose a problem.

While it may seem intuitive that a medication that blocks testosterone would not have a performance enhancing effect, spironolactone is a diuretic agent: a class of medications that are banned in sport due to their potential to mask other agents. It is vital that the basketball team physician ensures that athletes are fully educated and aware that they are responsible for every medication, supplement, or herbal remedy they put in or on their body. Just because something is prescribed, does not mean it is permitted in sport.

Athletes should always make any prescribing physician aware of their inclusion in a registered testing pool. Athletes should always check in the **WADA Prohibited List** or on globaldro.com if the medication is permitted or banned in- or out-of-competition. If a condition does not have an alternative treatment using a permitted medication, the athlete must request the prescribing physician complete a Therapeutic Use Exemption and submit that to the national/regional testing authority and the FIBA before starting the medication.

For more information on TUE: **https://about.fiba.basketball/en/services/anti-doping/therapeutic-use-exemptions**

SHARE YOUR PHOTOS

Please send us your funny, interesting, or remarkable basketball pictures that we can share with the medical and sport science basketball community. Email: medical@FIBA.basketball

"The World on Our Shoulders" is a compelling documentary that delves into the dynamic and inspiring history of the FIBA Women's Basketball World Cup, spanning from its inception in 1953 to the upcoming tournament that will take place in Berlin from September 4 to 13 2026. Please visit the official website of the **FIBA Women's Basketball World Cup 2026** *for more information.*

The documentary uses archival footage and interviews with legendary players and coaches, as well as sports historians, to explore the triumphs, struggles, and breakthrough moments that shaped the competition. It is now **available on YouTube.**

THE STUDENT'S CORNER

This space is intended for sport science and medical students, residents, and fellows to contribute to our knowledge and conversation.

Please encourage your students to contribute to the Fast Break on a topic of their choosing related to basketball injury, rehabilitation or sport science. The work published here is reviewed and approved for submission by the student's preceptor.

Unfortunately, there were no student submissions to this edition of the Fast Break.

NEWS AND NOTABLE FROM THE FIBA MEDICAL COMMISSION

In 2026 the FIBA Medical Commission's educational programming will focus on core concepts for the team physician's preparedness at FIBA events. The date will be confirmed and shared soon. The recordings of previous webinar sessions can be found here: **https://about.fiba.basketball/en/services/medical/webinars**

Resources from the FIBA Medical Commission can be found here:
https://about.fiba.basketball/en/services/medical/information-for-medical-staff

BASKETBALL CME OPPORTUNITIES

A listing of varied sport medicine and basketball meetings and conferences you may be interested in attending:

Sports Medicine Australia conference events can be found here: **https://sma.org.au/about-sma/honour-board/sma-national-conferences/**

Sports Medicine New Zealand conference events can be found here: **https://sportsmedicine.co.nz/**

The Australasian College of Sport and Exercise Physicians events can be found here: **https://www.acsep.org.au/page/events**

The Asian Federation of Sport Medicine conference events can be found here: **https://afsm2024.com/index.php**

The South African Sports Medicine Association hosts several events throughout the year:

https://www.sasma.org.za/events/

The South African Sports Medicine Association hosts several events throughout the year:

https://www.sasma.org.za/events/

The British Association of Sport and Exercise Medicine conference events can be found here: **https://basem.co.uk/learning/**

The FIMS (International Sport Medicine Federation) list of events can be found here: **https://www.fims.org/news-events/events/**

The National Basketball Strength and Conditioning Association hosts a performance conference. Check here for the latest updates regarding the date of their next conference: **https://thenbsca.com.**

The Euroleague Strength and Conditioning Coaches Association list of upcoming events can be found here: **https://escca.net/events/.**

The High-Performance Basketball Symposium dates are coming soon: **https://www.highperformancebasketball.com/index.cfm.**

A listing of all the American Medical Society for Sports Medicine conferences can be found here:

https://www.amssm.org/Conferences.php

The Society for Sport Exercise and Performance Psychology website lists a number of mental performance educational opportunities:

https://www.apadivisions.org/division-47/about/resources/conferences

Conference Locate.com allows you to search globally for conferences on an extensive array of medical topics:

https://www.clocate.com

A listing of exercise physiology conferences across the world can be found here: **https://conferenceindex.org/conferences/exercise-physiology**

And for something a little different:

https://unconventional.com.au/conferences/south-america/medical-conferences/2024/

If you prefer self-study to earn CME credits while you are on vacation, have a look at these options.

Date	Location	Event website
Sept 9-11, 2026	Singapore (Singapore)	Medical Fair Asia + Medicine and Sports Conference
Jun 1-4, 2027	Indianapolis (USA)	American College of Sport Medicine Annual symposium