

Menarche to Menopause: A Team Approach for Treating Female Athletes With RED-S Across the Lifespan

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References

1. Mountjoy M, Sundgot-Borgen J, Burke L, et al. The IOC consensus statement: beyond the female athlete triad—relative energy deficiency in sport (RED-S). *Br J Sports Med*. 2014;48(7):491-497.
2. Keay N, Francis G. Infographic. Energy availability: concept, control, and consequences in relative energy deficiency in sport (RED-S). *Br J Sports Med*. 2019;53(20):1310-1311.
3. De Souza MJ, Nattiv A, Joy E, et al. 2014 Female Athlete Triad Coalition consensus statement on treatment and return to play of the female athlete triad: 1st International Conference held in San Francisco, CA, May 2012, and 2nd International Conference held in Indianapolis, IN, May 2013. *Clin J Sports Med*. 2014;24(2):96-119.
4. Holtzman B, Ackerman KE. Recommendations and nutritional considerations for female athletes: health and performance. *Sports Med*. 2021;51(Suppl 1):43-57.
5. Giannini A, Caretto M, Genazzani AR, Simoncini T. Neuroendocrine changes during menopausal transition. *Endocrines*. 2021;2(4):405-416.
6. Hoyt LT, Falconi AM. Puberty and perimenopause: reproductive transitions and their implications for women's health. *Soc Sci Med*. 2015;132:103-112.
7. Santos L, Elliott-Sale KJ, Sale C. Exercise and bone health across the lifespan. *Biogerontology*. 2017;18(6):931-946.
8. Aihie Sayer, Syddall H, Martin H, Patel H, Baylis D, Cooper C. The developmental origins of sarcopenia. *J Nutr Health Aging*. 2008;12(7):427-432.
9. Chidi-Ogbolu N, Baar K. Effect of estrogen on musculoskeletal performance and injury risk. *Front Physiol*. 2019;9:1834.
10. De Souza MJ, Toombs RJ. Amenorrhea associated with the female athlete triad: etiology, diagnosis, and treatment. In: Santoro NF, Neal-Perry G, eds. *Amenorrhea: A Case-Based, Clinical Guide (Contemporary Endocrinology)*. Humana Press: Totowa, NJ; 2010.
11. Huhmann K. Menses requires energy: a review of how disordered eating, excessive exercise, and high stress lead to menstrual irregularities. *Clin Ther*. 2020;42(3):401-407.
12. Loucks AB, Thuma JR. Luteinizing hormone pulsatility is disrupted at a threshold of energy availability in regularly menstruating women. *J Clin Endocrinol Metab*. 2003;88(1):297-311.
13. Ihle R, Loucks AB. Dose-response relationships between energy availability and bone turnover in young exercising women. *J Bone Miner Res*. 2004;19(8):1231-1240.

14. Loucks AB, Kiens B, Wright HH. Energy availability in athletes. *J Sports Sci*. 2011;29 Suppl 1:S7-S15.
15. Ackerman KE, Cano Sokoloff N, DE Nardo Maffazioli G, Clarke HM, Lee H, Misra M. Fractures in relation to menstrual status and bone parameters in young athletes. *Med Sci Sports Exerc*. 2015;47(8):1577-1586.
16. Rizzone KH, Ackerman KE, Roos KG, Dompier TP, Kerr ZY. The epidemiology of stress fractures in collegiate student-athletes, 2004–2005 through 2013–2014 academic years. *J Athl Train*. 2017;52(10):966-975.
17. Albisetti W, Perugia D, De Bartolomeo O, Tagliabue L, Camerucci E, Maria Calori G. Stress fractures of the base of the metatarsal bones in young trainee ballet dancers. *Int Orthop*. 2010;34(1):51-55.
18. Warrick AE, Hassid B, Coleman B, Cansino C, Faustin M. Multidisciplinary physician survey assessing knowledge of the female athlete triad and relative energy deficiency in sport: supplementary material. *J Eat Disord*. 2023;11(1):70.
19. Kuikman MA, Mountjoy M, Stellingwerff T, Burr JF. A review of nonpharmacological strategies in the treatment of relative energy deficiency in sport. *Int J Sport Nutr Exerc Metab*. 2021;31(3):268-275.
20. Burke LM, Lundy B, Fahrenholtz IL, Melin AK. Pitfalls of conducting and interpreting estimates of energy availability in free-living athletes. *Int J Sport Nutr Exerc Metab*. 2018;28(4):350-363.
21. Centers for Disease Control and Prevention. 2 to 20 years: girls stature-for-age and weight-for-age percentiles. <https://www.cdc.gov/growthcharts/data/set2clinical/cj41c072.pdf>. Published May 30, 2000. Accessed June 1, 2023.
22. Modan-Moses D, Yaroslavsky A, Kochavi B, et al. Linear growth and final height characteristics in adolescent females with anorexia nervosa. *PLOS ONE*. 2012;7(9):e45504
23. Sale C, Elliott-Sale KJ. Nutrition and athlete bone health. *Sports Med*. 2019;49(Suppl 2):139-151.
24. Thomas DT, Erdman KA, Burke LM. Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: nutrition and athletic performance. *J Acad Nutr Diet*. 2016;116(3):501-528.
25. Calcium — calcium calculator. International Osteoporosis Foundation website. <https://www.osteoporosis.foundation/educational-hub/topic/calcium-calculator>. Accessed May 17, 2023.
26. de la Puente Yagüe M, Collado Yurrita L, Ciudad Cabañas MJ, Cuadrado Cenzual MA. Role of vitamin D in athletes and their performance: current concepts and new trends. *Nutrients*. 2020;12(2):579.
27. Taylor CL, Thomas PR, Aloia JF, Millard PS, Rosen CJ. Questions about vitamin D for primary care practice: input from an NIH conference. *Am J Med*. 2015;128(11):1167-1170.
28. Owens DJ, Allison R, Close GL. Vitamin D and the athlete: current perspectives and new challenges. *Sports Med*. 2018;48(Suppl 1):3-16.

29. Petkus DL, Murray-Kolb LE, De Souza MJ. The unexplored crossroads of the female athlete triad and iron deficiency: a narrative review. *Sports Med*. 2017;47(9):1721-1737.

30. Smith-Ryan AE, Cabre HE, Moore SR. Active women across the lifespan: nutritional ingredients to support health and wellness. *Sports Med*. 2022;52(Suppl 1):101-117.

31. Keay N. Act 1, Scene 5XX. In: *Hormones, Health and Human Potential: A Guide to Understanding Your Hormones to Optimise Your Health and Performance*. Sequoia Books; 2022.

32. Stellingwerff T, Heikura IA, Meeusen R, et al. Overtraining syndrome (OTS) and relative energy deficiency in sport (RED-S): shared pathways, symptoms, and complexities. *Sports Med*. 2021;51(11):2251-2280.

33. Mountjoy M, Sundgot-Borgen J, Burke L, et al. The IOC relative energy deficiency in sport clinical assessment tool (RED-S CAT). *Br J Sports Med*. 2015;49(21):1354.

34. Curry EJ, Logan C, Ackerman K, McInnis KC, Matzkin EG. Female athlete triad awareness among multispecialty physicians. *Sports Med Open*. 2015;1(1):38.

35. Management of Osteoporosis in Postmenopausal Women: The 2021 Position Statement of The North American Menopause Society Editorial Panel. Management of osteoporosis in postmenopausal women: the 2021 position statement of the North American Menopause Society. *Menopause*. 2021;28(9):973-997.

36. Papageorgiou M, Kerschman-Schindl K, Sathyapalan T, Pietschmann P. Is weight loss harmful for skeletal health in obese older adults? *Gerontology*. 2020;66(1):2-14.

37. Melin A, Tornberg ÅB, Skouby S, et al. The LEAF questionnaire: a screening tool for the identification of female athletes at risk for the female athlete triad. *Br J Sports Med*. 2014;48(7):540-545.

38. Keay N, Overseas A, Francis G. Indicators and correlates of low energy availability in male and female dancers. *BMJ Open Sport Exerc Med*. 2020;6(1):e000906.

Additional Resources:

Ackerman KE, Rogers MA, Heikura IA, et al. Methodology for studying Relative Energy Deficiency in Sport (REDs): a narrative review by a subgroup of the International Olympic Committee (IOC) consensus on REDs British Journal of Sports Medicine 2023;57:1136-1147.