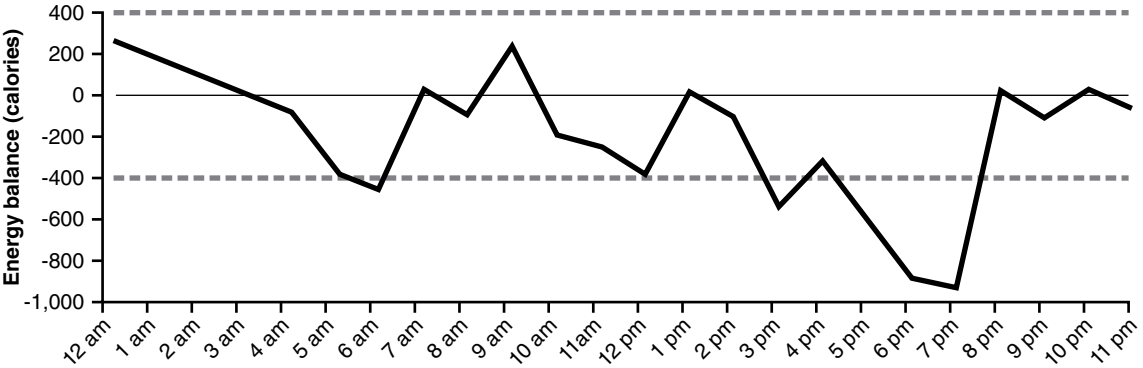


Within-Day Energy Balance

Within-day energy balance is important for athletes to sustain. There is increasing evidence that spending time in an energy-balance deficit in real time, now referred to as *relative energy deficiency in sport* (RED-S), causes multiple health and performance problems. The “calories in, calories out” paradigm, often expressed in 24-hour units, is misleading because the body works in real time. Studies are increasingly showing that time spent in an energy deficit is likely to create multiple problems, even if the athlete is in an overall 24-hour energy balance. Imagine that your capacity for fuel (energy) is finite—if you have too little, problems will occur, and if you have too much, problems will also occur. The athlete’s goal is to never let the fuel tank overfill and to never let it get too empty. Problems associated with energy inadequacy and excess are provided in the table on page 438.

In the following sample energy-balance graph, the energy balance of this athlete is near perfect at the end of the day, but the severe energy deficit during the day is likely to cause both performance and health issues.

Energy inadequacy	Energy excess
Poor training benefit	Higher body mass
Problem maintaining existing lean mass	Higher body-fat percent
Lowering of metabolic rate	Cardiac insufficiency
Increasing difficulty with normal eating	Increased risk of type 2 diabetes
Lower nutrient intake	Increased risk of hypertension
Lower bone mineral density	Lower disease resistance
Higher cortisol (stress hormone)	Dieting-mediated adaptive energy thermodynamics
Reduced athletic performance	Reduced athletic performance
Increased risk of injury	Increased risk of injury
Increased risk of disordered eating/eating disorder	Increased risk of disordered eating/eating disorder



SOURCES: I.L. Fahrenholtz et al., “Within-Day Energy Deficiency and Reproductive Function in Female Endurance Athletes,” *Scandinavian Journal of Medicine & Science in Sports* 28, no. 3 (2018): 1139-1146; M.K. Torstveit et al., “Within-Day Energy Deficiency and Metabolic Perturbation in Male Endurance Athletes,” *International Journal of Sport Nutrition and Exercise Metabolism* 28, no. 4 (2018): 1-28.

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