Increased Lean Mass With Reduced Fat Mass in an Elite Female Cyclist Returning to Competition: Case Study

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Body composition in a female road cyclist was measured using dual-energy X-ray absorptiometry (5 occasions) and anthropometry (10 occasions) at the start of the season (Dec to Mar), during a period of chronic fatigue associated with poor weight management (Jun to Aug), and in the following months of recovery and retraining (Aug to Nov). Dietary manipulation involved a modest reduction in energy availability to 30–40 kcal · kg fat-free mass–1 · d–1 and an increased intake of high-quality protein, particularly after training (20 g). Through the retraining period, total body mass decreased (–2.82 kg), lean mass increased (+0.88 kg), and fat mass decreased (–3.47 kg). Hemoglobin mass increased by 58.7 g (8.4%). Maximal aerobic- and anaerobic-power outputs were returned to within 2% of preseason values. The presented case shows that through a subtle energy restriction associated with increased protein intake and sufficient energy intake during training, fat mass can be reduced with simultaneous increases in lean mass, performance gains, and improved health.

Keywords: cycling, body composition, anthropometry, dual-energy X-ray absorptiometry

While the importance of being lean is recognized among elite cyclists, little attention has focused on how to best optimize body composition. As such, extreme weight-loss techniques have been popularized.1 Loss of body mass as a result of energy restriction often results in reduced body fat and lean mass.2 For an athlete, reductions in functional lean mass may be undesirable.

Purpose

Body composition of an elite female cyclist (age 21 y, height 170 cm, mass ~59 kg) recovering from postviral fatigue was monitored. The intervention objective was to reduce fat and increase lean mass simultaneously while improving health and performance.

Methods

Body composition was measured using dual-energy X-ray absorptiometry.3 Body mass and skinfolds were measured in duplicate using calibrated calipers (Harpenden West Sussex, England) at 7 sites (triceps, subscapular, biceps, supraspinale, abdominal, front thigh, and medial calf).4 Performance was monitored using mean maximal power (MMP)—highest average power output (W) sustained for 1 (MMP1) and 4 minutes (MMP4). MMP was measured in the field (race or training) monthly using an SRM (Schoberer Rad Messtechnik, Jülich) power-meter fitted.

Background

The athlete was healthy from preseason (December) to early season (March). VO2max was 59.7 mL · kg–1 · min–1; MMP4 ranged from 287 to 300 W, MMP1 ranged from 402 to 439 W, and body composition was within the athlete’s normal range (Figure 1). By midseason (June) MMP4 was still high at 303 W, however; shorter anaerobic efforts were not tolerated (MMP1 = 379 W) and race performance declined. Despite training modifications, health deteriorated and by late season (August) the athlete was diagnosed with postviral fatigue. Blood tests (full blood count; iron studies; markers of thyroid, kidney, and liver function; and inflammation) were all normal. From early to late season, body mass increased 3.02 kg and skinfolds increased 18 mm (Figure 1). Fat mass increased 3.84 kg and lean mass decreased 1.36 kg (Figure 2).

Physique-Manipulation Intervention

The athlete completed a 7-day food log preintervention and at the start of the intervention. Daily energy intake (EI) was calculated using a software package (FoodWorks 7; Xyris Software, Queensland, Australia). Cycling energy expenditure (EE) was estimated using SRM Power Meter data (estimated gross efficiency of 20%). Dietary counseling assisted in reducing energy availability (EA = EI – exercise EE) to ~30–40 kcal · kg fat-free mass–1.
Meals were adjusted in volume (increased) and energy density (reduced) by adding food items such as cooked and raw vegetables, soups, and fruits. Rides ended at times that allowed regular meals to become the recovery meal. Total-body resistance training was performed 3 times weekly. Bike training included single-leg ergometer work and low-cadence high-force efforts ("strength endurance"). Low-intensity 30-minute sessions were performed in a morning fasted state to promote fat utilization. After 8 weeks, ride duration progressed to 5 hours twice weekly. During rides ≥2 hours, a carbohydrate intake target of >60 g/h was introduced to optimize exogenous fuel support. Gym sessions and rides ≥2 hours were immediately followed by 20 g of high-quality protein using a liquid meal supplement (PowerBar Protein Plus powder, PowerBar Australia).

### Results

Preintervention EA (Mean ± SD) was ~41 ± 6 kcal · kg fat-free mass⁻¹ · d⁻¹ (carbohydrate, fat, protein; 481, 71, 143 g) while the early-intervention EA was ~35 ± 6 kcal · kg fat-free mass⁻¹ · d⁻¹ (carbohydrate, fat, protein; 382, 66, 155 g). There was a continual reduction of body mass (2.82 kg) due to a 3.47-kg reduction in fat while lean mass increased by 0.88 kg (Figure 1 and 2). Lean mass increased most in the trunk (0.61 kg) followed by the arms (0.23 kg), with little change in the legs (0.03 kg). Hemoglobin mass increased by 58.7 g (8.4%) in 6 weeks (October to December). By November, MMP4 was 286 W and MMP1 was 394 W.

### Discussion

This case demonstrates that fat mass can be reduced and lean mass increased during modest energy restriction, provided the dietary intake of high-quality proteins is increased throughout the day and increased to 20 g after training and that >60 g/h carbohydrate is consumed during training ≥2 hours. Improvements in health, hematological adaptations, and performance were also supported. Note that when energy balance was restored (October), fat mass continued to decrease while lean mass was preserved, suggesting favorable changes in body composition without being energy restricted.

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### References


