

ORIGINAL RESEARCH COMMUNICATION

Calorie restriction accelerates the catabolism of lean body mass during 2 wk of bed rest^{1,2,3}

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Background: Muscle inactivity and low energy intake commonly occur in persons with acute or chronic disease, in astronauts during space flight, and during aging.

Objective: We used a crossover design to investigate the effects of the interactions of inactivity and calorie restriction on whole-body composition and protein kinetic regulation in 9 healthy volunteers.

Design: Lean body mass (LBM) was measured by using dual-energy X-ray absorptiometry before and at the end of 14-d periods of bed rest (B) and controlled ambulation (A) in patients receiving eucaloric (E) or hypocaloric (H) ($\approx 80\%$ of total energy expenditure) diets. Whole-body leucine kinetics were determined at the end of the 4 study periods by using a standard stable-isotope technique in the postabsorptive state and during a 3-h infusion of a $0.13 \text{ g} \cdot \text{kg LBM}^{-1} \cdot \text{h}^{-1}$ amino acid mixture.

Results: In the postabsorptive state, we found a significant ($P = 0.04$) bed rest x hypocaloric diet interaction for the rate of leucine oxidation, an index of net protein catabolism (A+E: 0.23 ± 0.01 ; B+E: 25 ± 0.01 ; A+H: 0.23 ± 0.01 ; B+H: $0.28 \pm 0.01 \mu\text{mol} \cdot \text{min}^{-1} \cdot \text{kg LBM}^{-1}$). Bed rest significantly ($P < 0.01$) decreased amino acid-mediated stimulation of nonoxidative leucine disappearance, an index of protein synthesis (A+E: $35 \pm 2\%$; B+E: $30 \pm 2\%$; A+H: $41 \pm 3\%$; B+H: $32 \pm 2\%$). B+H decreased LBM by $1.10 \pm 0.1 \text{ kg}$, which is significantly ($P < 0.01$) greater than the decrease seen with A+E, A+H, or B+E.

Conclusion: Calorie restriction enhanced the catabolic response to inactivity by combining greater protein catabolism in the postabsorptive state with an impaired postprandial anabolic utilization of free amino acids.

Key Words: Healthy volunteers • muscle inactivity • protein metabolism • hypocaloric diet • bed rest • leucine kinetics • lean body mass

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