

Strength training increases regional bone mineral density and bone remodeling in middle-aged and older men

1. A. Menkes,
2. S. Mazel,
3. R. A. Redmond,
4. K. Koffler,
5. C. R. Libanati,
6. C. M. Gundberg,
7. T. M. Zizic,
8. J. M. Hagberg,
9. R. E. Pratley, and
10. B. F. Hurley

± Author Affiliations

1. *University of Maryland, Department of Kinesiology, College Park 20742.*

Abstract

To determine the effects of strength training (ST) on bone mineral density (BMD) and bone remodeling, 18 previously inactive untrained males [mean age 59 \pm 2 (SE) yr] were studied before and after 16 wk of either ST (n = 11) or no exercise (inactive controls; n = 7). Total, spinal (L2–L4), and femoral neck BMD were measured in nine training and seven control subjects before and after the experimental period. Serum concentrations of osteocalcin, skeletal alkaline phosphatase isoenzyme, and tartrate-resistant acid phosphatase were measured before, during, and after the experimental program in all subjects. Training increased muscular strength by an average of 45 \pm 3% (P < 0.001) on a three-repetition maximum test and by 32 \pm 4% (P < 0.001) on an isokinetic test of the knee extensors performed at 60 degrees/s. BMD increased in the femoral neck by 3.8 \pm 1.0% (0.900 \pm 0.05 vs. 0.933 \pm 0.05 g/cm², P < 0.05) and in the lumbar spine by 2.0 \pm 0.9% (1.180 \pm 0.06 vs. 1.203 \pm 0.06 g/cm², P < 0.05). However, changes in lumbar spine BMD were not significantly different from those in the control group. There was no significant change in total body BMD. Osteocalcin increased by 19 \pm 6% after 12 wk of training (P < 0.05) and remained significantly elevated after 16 wk of training (P < 0.05). There was a 26 \pm 11% increase in skeletal alkaline phosphatase isoenzyme levels (P < 0.05) after 16 wk of training.