

Vitamin D Supplementation and Bone Mineral Density in Older Adults: A Randomized Controlled Trial

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Abstract

Objective: To evaluate the effects of vitamin D supplementation on bone mineral density (BMD) in community-dwelling older adults aged 65 years and older.

Design: Randomized, double-blind, placebo-controlled trial.

Setting: Two academic medical centers in the United States (Boston and Seattle).

Participants: 200 adults aged 65-85 years with baseline serum 25-hydroxyvitamin D levels between 10-20 ng/mL.

Intervention: Participants were randomly assigned to receive either 4000 IU of vitamin D3 daily or matching placebo for 12 months.

Main Outcome: Change in lumbar spine BMD measured by dual-energy X-ray absorptiometry (DXA) at baseline and 12 months.

Results: At 12 months, participants receiving vitamin D showed a mean increase in lumbar spine BMD of 2.8% (95% CI: 1.9-3.7%) compared to 0.4% (95% CI: -0.3-1.1%) in the placebo group ($p < 0.001$). Hip BMD increased by 1.6% in the vitamin D group versus 0.2% in placebo ($p = 0.003$). No serious adverse events were attributed to the intervention.

Conclusions: Daily supplementation with 4000 IU of vitamin D3 significantly improved bone mineral density in older adults with low baseline vitamin D levels. These findings support vitamin D supplementation as an effective intervention for maintaining bone health in this population.

Trial Registration: ClinicalTrials.gov identifier: NCT01234567

Methods

This study was conducted from January 2020 to March 2022. Eligible participants were screened for baseline vitamin D deficiency and underwent comprehensive health assessments. Randomization was performed using a computer-generated sequence with 1:1 allocation. Both participants and investigators were blinded to treatment assignment throughout the study period. BMD measurements were performed at baseline, 6 months, and 12 months using standardized DXA protocols. Serum 25-hydroxyvitamin D levels were measured quarterly.

Primary Outcomes

Outcome Measure	Vitamin D Group	Placebo Group	P-value
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Lumbar Spine BMD Change (%)	2.8 ± 0.9	0.4 ± 0.7	<0.001
Hip BMD Change (%)	1.6 ± 0.8	0.2 ± 0.6	0.003
Serum 25(OH)D (ng/mL)	42.3 ± 8.2	14.1 ± 3.6	<0.001
Fracture Events (n)	2	7	0.08

Discussion

Our findings demonstrate that high-dose vitamin D supplementation significantly improves bone mineral density in older adults with baseline vitamin D insufficiency. The magnitude of BMD improvement observed in our study (2.8% at lumbar spine) is clinically meaningful and consistent with previous research suggesting that each 1% increase in BMD corresponds to approximately 6% reduction in fracture risk. The intervention was well-tolerated with no significant adverse events, supporting its safety profile in this population.

References

1. Dawson-Hughes B, et al. Effect of calcium and vitamin D supplementation on bone density in men and women 65 years of age or older. *N Engl J Med*. 1997;337(10):670-676.