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Effects of vitamin D supplements on bone mineral density: a systematic review and meta-analysis

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Summary

Background

Findings from recent meta-analyses of vitamin D supplementation without co-administration of calcium have not shown fracture prevention, possibly because of insufficient power or inappropriate doses, or because the intervention was not targeted to deficient populations. Despite these data, almost half of older adults (older than 50 years) continue to use these supplements. Bone mineral density can be used to detect biologically significant effects in much smaller cohorts. We investigated whether vitamin D supplementation affects bone mineral density.

Methods

We searched Web of Science, Embase, and the Cochrane Database, from inception to July 8, 2012, for trials assessing the effects of vitamin D (D3 or D2, but not vitamin D metabolites) on bone mineral density. We included all randomised trials comparing interventions that differed only in vitamin D content, and which included adults (average age >20 years) without other metabolic bone diseases. We pooled data with a random effects meta-analysis with weighted mean differences and 95% CIs reported. To assess heterogeneity in results of individual studies, we used Cochran's Q statistic and the I^2 statistic. The primary endpoint was the percentage change in bone mineral density from baseline.

Findings

Of 3930 citations identified by the search strategy, 23 studies (mean duration 23.5 months, comprising 4082 participants, 92% women, average age 59 years) met the inclusion criteria. 19 studies had mainly white populations. Mean baseline serum 25-hydroxyvitamin D concentration was less than 50 nmol/L in eight studies (n=1791). In ten studies (n=2294), individuals were given vitamin D doses less than 800 IU per day. Bone mineral density was measured at one to five sites (lumbar spine, femoral neck, total hip, trochanter, total body, or forearm) in each study, so 70 tests of statistical significance were done across the studies. There were six findings of significant benefit, two of significant detriment, and the rest were non-significant. Only one study showed benefit at

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more than one site. Results of our meta-analysis showed a small benefit at the femoral neck (weighted mean difference 0.8%, 95% CI 0.2–1.4) with heterogeneity among trials ($I^2=67%$, $p<0.00027$). No effect at any other site was reported, including the total hip. We recorded a bias toward positive results at the femoral neck and total hip.

Interpretation

Continuing widespread use of vitamin D for osteoporosis prevention in community-dwelling adults without specific risk factors for vitamin D deficiency seems to be inappropriate.

Funding

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