



## Effects of calcium intake on bone mineral density and fracture risk

Two meta-analyses have found that increasing calcium intake, either through diet or using supplements, did not have a consistent effect on bone mineral density and incidence of fracture in people aged over 50 years.

### Overview:

- One systematic review and meta-analysis found that increasing dietary calcium or taking calcium supplements produced small increases in bone mineral density (BMD) in people aged more than 50 years, without much further improvement in BMD beyond 1 year.
- A second systematic review and meta-analysis in people aged over 50 years reported that increasing dietary calcium did not affect risk of fracture, whereas calcium supplements had small effects on total and vertebral fractures but not fractures at other sites.
- Calcium and vitamin D supplementation should not normally be used as the only treatment for osteoporosis but may still be appropriate in people receiving pharmacological treatment for osteoporosis.

**Background:** Bone density naturally decreases with age, causing osteoporosis and increasing the risk of fracture in some older people ([NHS Choices 2015](#)). Maintaining sufficient intake of calcium has been thought to reduce the risk of fracture in older people. US guidelines recommend that adults over the age of 50 years consume 1000–1200 mg of calcium a day ([Institute of Medicine 2011](#)).



Calcium intake can be increased through dietary sources, such as milk and cheese, supplements or both. However, calcium supplements have been associated with side effects such as heart attack ([Bolland et al. 2010](#)). As a result, some experts have questioned the risk:benefit ratio of calcium supplements in older people ([Bauer 2013](#)).

**Current advice:** NICE [technology appraisal guidance](#) recommends the bisphosphonates alendronate, etidronate and risedronate, as well as strontium ranelate and the selective oestrogen receptor modulator raloxifene, for the primary prevention of osteoporotic fragility fractures in certain postmenopausal women. [NICE also recommends](#) these drugs and teriparatide for the secondary prevention of osteoporotic fragility fractures in postmenopausal women.

The monoclonal antibody [denosumab](#) is recommended as an alternative treatment option in postmenopausal women at increased risk of fractures.

NICE does not make any recommendations on calcium intake to reduce fracture risk in older people.

The NICE pathway on [osteoporosis](#) brings together all related NICE guidance and associated products on the condition in a set of interactive topic-based diagrams.

**New evidence:** Two meta-analyses have assessed how increasing dietary calcium or using calcium supplements affected bone mineral density (BMD) and risk of fracture in people aged over 50 years.

The first meta-analysis by [Tai et al. \(2015\)](#) found 59 randomised controlled trials (RCTs) of calcium intake in people aged over 50 years that reported BMD as an outcome. Most trials looked at women who were living in the community.

In meta-analyses of the 15 trials that studied dietary sources of calcium (n=1533), increasing calcium intake improved BMD by 0.6–1.0% at the hip and in total body measurements at 1 year. At 2 years, BMD had increased by 0.7–1.8% at these sites and at the lumbar spine and femoral neck.

In meta-analyses of the 51 studies on calcium supplements (n=12,257), supplements increased BMD by 0.7–1.8% at all 5 skeletal sites assessed (lumbar spine, femoral neck, hip, forearm and total body) at 1 year, 2 years and more than 2.5 years.

In the second meta-analysis, [Bolland et al. \(2015\)](#) searched for RCTs and cohort studies on the effects of calcium intake on fracture in people aged over 50 years.

The authors identified 1 RCT (n=200) and 44 cohort studies (n=>60,000) on dietary sources of calcium. The single RCT found that increasing dietary calcium with milk powder did not significantly affect fracture risk. Among the cohort studies, no effect on fracture risk was found in 74% of analyses of dietary calcium, 89% of analyses of specifically milk intake and 85% of analyses of dairy intake.

A total of 26 RCTs (n=69,107) were found that assessed the effects of calcium supplements on fracture risk. Participants were mostly women aged 70 years or older.

Meta-analyses of these trials showed that calcium supplements reduced the risk of any fracture (relative risk [RR]=0.89, 95% confidence interval [CI] 0.81 to 0.96, p=0.004; 20 studies, n=58,573) and vertebral fracture (RR=0.86, 95% CI 0.74 to 1.00, p=0.04; 12 studies, n=48,967). However, no effect was seen on hip fracture (RR=0.95, 95% CI 0.76 to 1.18, p=0.63; 13 studies, n=56,648) or forearm fracture (RR=0.96, 95% CI 0.85 to 1.09; p=0.54; 8 studies, n=51,775).

Among 11 cohort studies of calcium supplements, 75% of the analyses reported no association or a negative association between supplements and fractures.

**Commentary by Professor Peter Selby, Consultant Physician, Central Manchester University Hospitals NHS Foundation Trust and Honorary Professor of Metabolic Bone Disease, University of Manchester:**

“These 2 studies are the culmination of a series of publications by the same group in New Zealand. They have sought to demonstrate the limited utility of calcium intake in the prevention of osteoporotic fractures.

“The first paper (Tai et al. 2015) is a systematic review and meta-analysis that assessed the effect of calcium intake on BMD. This showed that increasing calcium intake – whether by dietary means or pharmacological supplementation – led to a modest increase in BMD of about 1%. This increase appeared to occur in the first year and then remained static.

“The second meta-analysis (Bolland et al. 2015) examined the effect of calcium intake on fracture incidence. This showed that increased calcium intake was associated with an 11% reduction in all fractures. However, the benefit varied between fractures sites, with a greater reduction in vertebral fracture and no significant reduction in hip or forearm fractures.

“The authors interpreted both these studies as being indicative of little or no benefit to the skeleton from increasing calcium intake. However, the changes in bone density are of a similar magnitude to some of the weaker agents licensed for the treatment of osteoporosis. Further, a reduction of 11% in all fractures and 14% in vertebral fractures, although not as large as seen with many other treatments for osteoporosis, cannot be dismissed as being of no clinical utility.

“Calcium supplementation is no longer widely used as a primary treatment for osteoporosis. However, it must be remembered that nearly all clinical trials of other osteoporosis treatments have used calcium and vitamin D supplementation as part of therapy. Therefore, the available evidence shows that these treatments for osteoporosis work only in the presence of adequate calcium and vitamin D intake. Accordingly, it is important that these two meta-analyses are not taken as suggesting that calcium and vitamin D supplementation is not indicated in people receiving pharmacological treatment for osteoporosis, especially where there is doubt regarding the basal calcium and vitamin D status of the patient.”

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