

Brief summary of the evidence that calcium supplementation is beneficial in the prevention of bone loss and fractures in older adults

Dietary calcium intake has been linked to fracture rates epidemiologically (1).

In a meta-analysis of calcium supplementation in the prevention of postmenopausal osteoporosis that included 15 controlled trials (1806 subjects), Shea and colleagues (2, 3) found that calcium supplementation was more effective than placebo in reducing rates of bone loss after two or more years of treatment. The pooled difference in percentage change in BMD from baseline at the total body was 2.05%, at the lumbar spine 1.66%, at the hip 1.64% and distal radius 1.91%. The relative risk of vertebral fracture was 0.77 (95%CI 0.54-1.09) and nonvertebral fracture 0.86 (95% CI 0.43-1.72).

Heaney reviewed 139 papers published between 1975 and 2000 related to calcium, dairy products and bone health (4). Fifty of 52 calcium intervention studies showed better bone balance at high intakes, or greater bone gain during growth, or reduced bone loss in the elderly, or reduced fracture risk.

In an analysis of 20 calcium trials conducted up to 1997, Nordin (5) concluded that the mean bone loss in controls was 1% per yr, whereas the rate of loss in calcium-treated subjects was only 0.014% per year.

In a randomised, placebo-controlled study of 301 postmenopausal women, Dawson-Hughes et al (6) showed that in those with low calcium intake (<400 mg/day) increasing calcium intake to 800 mg/day for two years significantly reduced bone loss.

Reid et al (7) showed in a randomised, placebo-controlled study of postmenopausal women with a mean calcium intake of 750 mg/day that a calcium supplement of 1000 mg/day reduced the rate of bone loss at the total body by 43% and at Ward's triangle by 67%. Calcium use was of significant benefit to the lumbar spine and reduced biochemical parameters of bone turnover.

Peacock et al (8) in a randomized, double blind placebo-controlled trial compared treatment over 4 yrs with calcium supplement (750 mg/day), 25OH Vitamin D (15 µg/day) or placebo in 316 women and 122 men over 60ys (average age approx 75ys). The calcium group did not show any significant loss of BMD at the total hip, while the placebo group lost 0.0144 g/cm² or 2%. Vitamin D had an intermediate effect. Calcium also reduced femoral medulla expansion, secondary hyperparathyroidism and bone turnover.

There is evidence that calcium supplements are most beneficial in the first year of treatment, which is probably due to increased calcium intake reducing PTH levels, suppressing the activation of new remodelling units. However, Reid et al (9) have demonstrated a small ongoing positive effect of about 0.25% per year after the first year. If this small effect persisted for 30 yrs the cumulative positive effect of 7.5% would reduce fracture risk by approximately one third (10).

Few randomized trials have assessed the effect of calcium supplements on fracture risk. Three of these (9, 11, 12) have been small studies (78-197 subjects) that showed 30 to 70% reductions in the point estimate for the relative risk of fracture. The much larger study of Chapuy et al (13) (3270 nursing home residents, mean age 84 yrs) compared calcium *plus vitamin D* with placebo over 18 months. This study showed a 43% reduction in hip fracture (p=0.043) and a 32% reduction in all non-vertebral fractures (p=0.015). A subsequent study by this group showed similar results (14). Cumming and Nevitt (15) systematically reviewed the literature relating to calcium supplements in the prevention of fractures in post menopausal women. Pooled data from 16 observational studies

of calcium supplements and hip fracture indicated an odds ratio of 0.96 (95% CI, 0.93-0.99) per 300 mg/day increase in calcium intake (the equivalent of one glass of milk).

Dietary calcium intakes in Australia are well below the NHMRC recommended daily intake.

A random sample of Australian women aged 55-92 years participating in the Geelong Osteoporosis Study had a mean dietary calcium intake of 646 mg/day (range 46-2072) (16), well below the NHMRC recommended daily intake (RDI) for this age group of 1000 mg/day. Fourteen percent of all women in this study (aged 20-92) had intakes below 300 mg/day (including supplements), the limit below which women cannot adapt (17). Although calcium intake can be increased by dietary means, long-term adherence to high calcium diets is poor (18).

The efficacy of bisphosphonate and SERM therapy in fracture prevention in the absence of a calcium supplement is unknown.

Calcium supplements form an integral part of bisphosphonate and SERM therapy for established osteoporosis. The landmark clinical trials demonstrating the efficacy of these therapies used calcium, with or without vitamin D, in the active treatment arms (19-24).

Calcium supplements are required treatment in renal bone disorders.

Renal osteodystrophy is a major cause of morbidity in endstage renal disease, occurring in 75-100% of patients with chronic renal failure. Control of serum phosphate is an integral part of the management of metabolic bone disease in renal failure patients (25). Furthermore, elevation of the calcium phosphate product in renal failure is associated with increased mortality and is strongly related to the presence of coronary artery disease and the occurrence of sudden death (26, 27).

Calcium supplements are required treatment in hypocalcaemic disorders

Calcium supplements are an integral component of the management of hypocalcemic disorders including hypoparathyroidism (primary, post-surgical) (28), vitamin D deficiency, vitamin D-resistant rickets/osteomalacia and pseudohypoparathyroidism.

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