

Falls prevention for older people: vitamin D, calcium or both?

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INTRODUCTION

Falls and fall-related fractures increase with age and affect skeletal and muscle health negatively.^{1,2} Insufficient vitamin D and calcium intake is a contributing factor to fall-related fractures in older people (aged ≥ 65 years). The use of vitamin D and calcium supplements by the general public has increased, especially among older people in nursing homes, under long-term care, or with prolonged hospitalisation. However, there is controversy regarding the actual clinical benefits of taking vitamin D with and without calcium. This article reviews the current evidence on the use of vitamin D supplements with and without calcium in older people, as a means of reducing falls and related fractures.

FALLS IN OLDER PEOPLE

Falls in older people are caused by intrinsic (medical conditions, impaired vision and hearing, age-related changes, and risk-taking behaviours) and extrinsic (medications, improper use of assistive devices, and environment [e.g. poor lighting, uneven surfaces, bulky furniture, etc]) factors acting alone or in combination. In Canada, persons aged over 65 years account for 40% of all injury-related hospitalisations; 85% of such hospitalisations were caused by falls.³ The mean cost of falls in older people escalated abruptly from US\$3476 per fall without injury to US\$10 749 with injury and to US\$26 483 needing hospitalisation.⁴ The incidence of falls in older people has been reported to be 30% in the USA,⁴ 46% in Spain,⁵ and 89% among villagers in Warsaw.⁶ 5%⁷ to

56%⁶ of falls in older people lead to fractures; 26% of those who sustained hip fractures die within 12 months.⁸ A vicious cycle ensues when a fall leads to fear of falling and reduction in physical activity, which in turn contributes to decline in health and vulnerability to future falls.^{9,10}

FALLS PREVENTION STRATEGIES

Falls prevention strategies include regular physical activity,¹¹ environmental adaptations minimising home hazards (e.g. hand rails, uncluttered surroundings, etc),¹² improved nutrition and vitamin D and/or calcium supplements to enhance bone and muscle health. The best preventive approach is interdisciplinary,¹³ with emphasis on regular exercise,¹⁴ which is often deficient in older people.^{15,16}

VITAMIN D FOR BONE AND MUSCLE

Vitamin D is fat soluble and synthesised from cholesterol. It exists in 2 forms: ergocalciferol (D_2) and cholecalciferol (D_3). D_2 is produced by conversion of dietary provitamin D via ultraviolet radiation through the skin, whereas D_3 comes from food and conversion via ultraviolet radiation. Vitamin D regulates calcium and phosphate metabolism through intestinal absorption, mediated through the enzyme 25-hydroxyvitamin D-1 α -hydroxylase (CYP27B1) found in kidney tubules.¹⁷ An extra autocrine/paracrine function of vitamin D can affect cell differentiation and proliferation, which maintains bone health and prevents osteoporosis (FIGURE).¹⁷ Vitamin D is crucial for normal functioning of the muscle¹⁸ and nervous system.¹⁹ Deficiency of vitamin

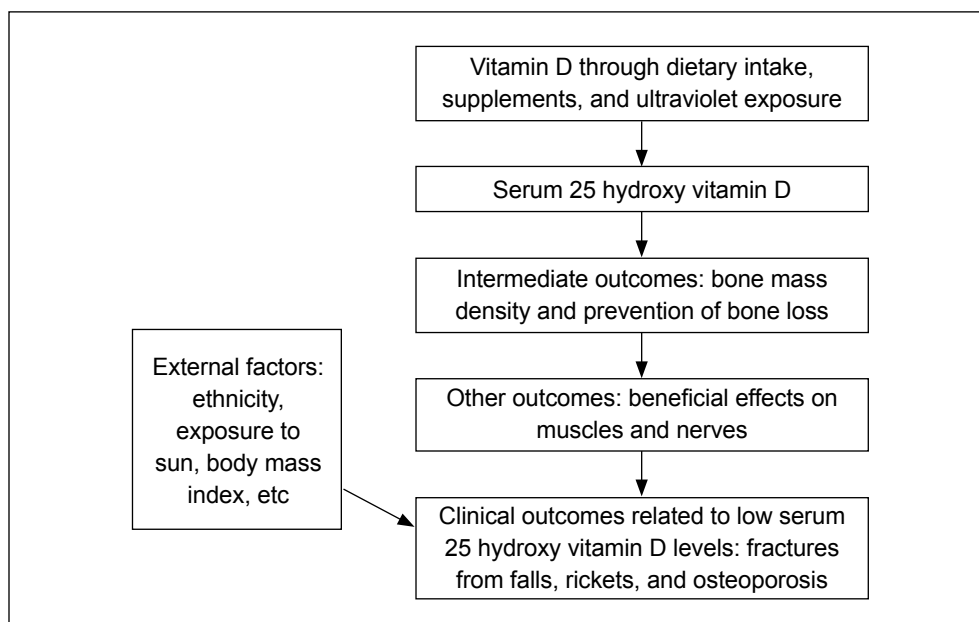


FIGURE. Vitamin D pathway to bone and muscle health

D is linked to myopathy, rickets in children, and osteomalacia in adults.²⁰⁻²² Older people are more predisposed to vitamin D deficiency,²² which can be as a result of low dietary intake, reduced sun exposure, and impaired conversion mechanism in the skin.

BENEFITS OF VITAMIN D

In community older people, decreased levels of serum hydroxyl vitamin D is associated with muscle weakness, which leads to poor balance and gait, predisposing to increased falls and fractures.^{1,20,23} Vitamin D also has a role in neuromuscular or neuroprotective function.²⁴ In a randomised, double-blind placebo-controlled trial,²⁴ a single intramuscular injection of 600 000 IU ergocalciferol significantly improves aggregate functional performance time in the following 6 months, compared to placebo injection. Vitamin D supplementation improves neuromuscular or neuroprotective function and thus reduces falls and fractures. In a meta-analysis with a total of 1237 subjects, vitamin D supplementation in the older people reduced the likelihood of falling by 22% (corrected odds ratio [OR], 0.78; 95% confidence interval [CI], 0.64-0.92), compared to patients receiving calcium or placebo.²⁵ The calculated number needed to treat was 15 (95% CI, 8-53), i.e. 15 subjects need to be treated with vitamin D to prevent one fall. In another meta-analysis,²⁶ daily intake of 200 to 1000 IU of vitamin D reduces falls in the

older people by 14%, compared to calcium alone or placebo (relative risk [RR], 0.86; 95% CI, 0.79-0.93).

BENEFITS OF VITAMIN D WITH CALCIUM

Calcium is the essential component for bones. Addition of vitamin D to calcium is beneficial in reduction of the risk of falls and or related fractures in older people.^{27,28} A single intervention with vitamin D plus calcium over a 3-month period reduces the risk of falling by 49%, compared to calcium alone.²⁷ However, other studies reported much smaller or no effects on falls and fracture reduction following treatment with vitamin D in combination with calcium.²⁸⁻³² In a pooled analysis, no benefit from treatment with Vitamin D alone in preventing fractures was found,³² but when given with calcium, the combination reduced hip and total fractures, irrespective of age, gender or history of fractures. Nonetheless, this analysis targeted women at high risk for hip fracture and not the general older population. The mean age group in the pooled analysis was 69.9 years.

NEITHER VITAMIN D NOR CALCIUM SUPPLEMENTATION

The best strategies for falls and fracture prevention in the older people should include regular physical activities, environmental adaptations, good nutrition,

nutritional education, and intake of vitamin D and/or calcium supplements. Consensus on the major contributors to reducing falls and fractures in the older people is lacking, be it vitamin D alone or in combination with calcium, regular physical activity, or change in dietary habits.

CONCLUSION

The role of vitamin D and calcium in maintaining bone and muscle health remains undisputed. Older people are predisposed to vitamin D deficiency. A multi-factorial prevention strategy (calcium and/or vitamin D supplementation, adequate exercises, and good nutrition) is preferred. Current evidence is still inconclusive regarding the efficacy of vitamin D alone or in combination with calcium. More rigorous double-blind, randomised, placebo-controlled trials with multiple arms are needed.

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