

Recommendations from the Vitamin D and Calcium Forum

This Forum, held in Melbourne on 28 and 29 July 2005, led to the development of important strategies for achieving improved vitamin D and calcium nutrition in the Australian community.

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Aims of the Vitamin D and Calcium Forum

The Vitamin D and Calcium Forum, an initiative of Osteoporosis Australia (OA) held in partnership with the Australian and New Zealand Bone and Mineral Society (ANZBMS), was held in Melbourne on 28 and 29 July 2005. The Forum aimed to bring together key stakeholder groups and experts to specifically develop recommendations regarding optimal vitamin D and calcium nutrition, as well as approaches to overcoming barriers to their successful implementation.

Optimal vitamin D and calcium nutrition is important in the maintenance of musculo-

skeletal health, but may also have broader effects on wellbeing in general.

It was recognised that vitamin D deficiency is an emerging public health problem and is surprisingly common – even in this country. Average dietary calcium intake in Australia is below the recommended daily intake and needs to be increased, particularly in young women. In addition, access to low cost and effective vitamin D and calcium supplementation needs to be made equitable for all Australians, regardless of age, gender and socioeconomic situation. Effective strategies to increase dietary calcium intake need to be identified.

Changes in bone microarchitecture in osteoporosis

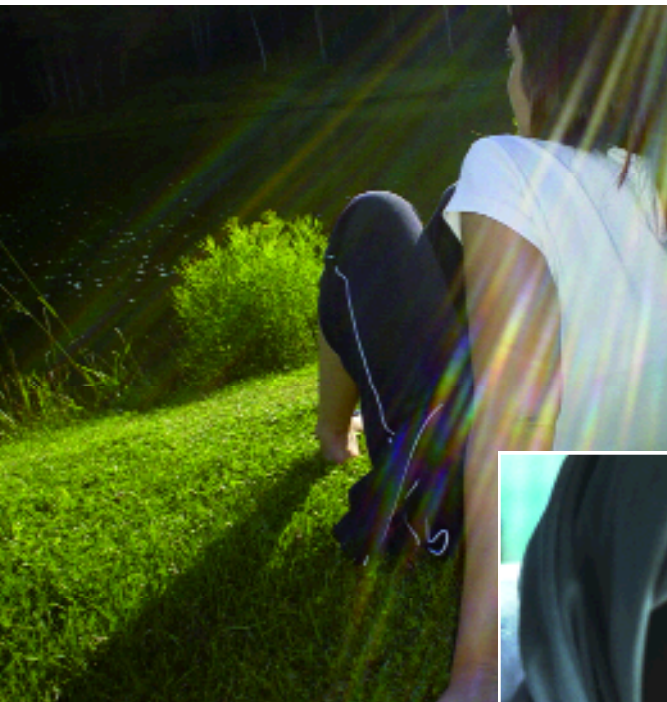
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Normal bone.

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Osteoporotic bone.

The Australian Government has provided funding to support this program; however, the views in this document are those of the authors and participants of the Vitamin D and Calcium Forum and do not necessarily represent the views of the Australian Government.



Modest sunlight exposure on most days is safe and likely to achieve vitamin D sufficiency. Exposure times vary according to latitude and skin pigmentation.



Achieving optimal vitamin D levels

- Vitamin D deficiency increases the risk of major illness and adverse health outcomes, especially osteoporosis, falls and fracture in the elderly. It is also associated with other conditions, including autoimmune diseases (rheumatoid arthritis, multiple sclerosis and type 1 diabetes), cardiovascular disease and some cancers.
- Major risk factors for vitamin D deficiency are:
 - elderly age and/or being institutionalised, house-bound or nonambulatory (i.e. having limited sunlight exposure)
 - cognitive impairment
 - gastrointestinal disease, especially with malabsorption
 - certain medications (such as antiepileptic agents that induce liver enzymes)
 - limited sunlight exposure or effect because of skin colour, ethnicity and/or cultural factors.
- Adequate vitamin D is particularly important for pregnant women with risk factors for vitamin D deficiency because of the long term effects of fetal deficiency, and for infants of women at risk (especially if breastfed).

Table. Sun exposure times that result in adequate vitamin D production without significant risk of skin damage for people with moderately fair skin*

	December-January	July-August	
Location	At 10 am or 2 pm [†]	At 10 am or 2 pm	At 12 noon
Australia			
Cairns	6 to 7 minutes	9 to 12 minutes	7 minutes
Townsville	5 to 7 minutes	9 to 13 minutes	7 minutes
Brisbane	6 to 7 minutes	15 to 19 minutes	11 minutes
Perth	5 to 6 minutes	20 to 28 minutes	15 minutes
Sydney	6 to 8 minutes	26 to 28 minutes	16 minutes
Adelaide	5 to 7 minutes	25 to 38 minutes	19 minutes
Melbourne	6 to 8 minutes	32 to 52 minutes	25 minutes
Hobart	7 to 9 minutes	40 to 47 minutes	29 minutes
New Zealand			
Auckland	6 to 8 minutes	30 to 47 minutes	24 minutes
Christchurch	6 to 9 minutes	49 to 97 minutes	40 minutes

* Exposure to achieve 1/3 minimal erythemal dose (MED) is advised to be before 10 am or after 3 pm. Exposure times for people with highly pigmented skin are three to six times greater. [†] 11 am or 3 pm daylight saving time, respectively. Adapted from: Working Group of the Australian and New Zealand Bone and Mineral Society, Endocrine Society of Australia and Osteoporosis Australia. Vitamin D and adult bone health in Australia and New Zealand: a position statement. Med J Aust 2005; 182: 281-284.

Diagnosing vitamin D deficiency

Recommendations

- The diagnosis of vitamin D deficiency involves a single measurement of serum 25-hydroxyvitamin D level by a reliable assay that measures 25-hydroxyvitamins D₂ and D₃ equally (i.e. that derived from ergocalciferol and cholecalciferol, respectively).
- Exclusion of hypocalcaemia and renal impairment may be required in the diagnosis of vitamin D deficiency.

Lifestyle and vitamin D levels

- Attainment of 25-hydroxyvitamin D values above 50 nmol/L may improve bone health.

Recommendations

- Consideration of lifestyle change (increased exposure to sunlight). Replacement therapy may be required for some people.
- Exposure of the face, hands and arms or of the legs to modest amounts of sunlight to reach one-third of a minimal erythemal dose (MED) on most days as part of daily living seems safe and likely to achieve vitamin D sufficiency. Exposure should occur before 10 am or after 3 pm for short periods of time, the duration of which depends on latitude and time of year (see Table). Individuals with darker skin will require three to six times longer sun exposure. (One MED is the amount of sun exposure that produces a faint redness of the skin.)
- Vitamin D fortification of some foods would widen dietary options for individuals to improve their vitamin D status. However, it is not likely to be sufficient in itself to treat frank vitamin D deficiency or to prevent it in people at high risk.

Vitamin D replacement

- Vitamin D supplementation reduces the risk of falls by 30% among people in residential care.
- Vitamin D replacement is relatively expensive using preparations that deliver 1000 IU (25 µg) daily.
- Higher dose formulations available in the USA, Europe, Asia and New Zealand are not currently available in Australia.
- Vitamin D₃ appears to be more effective than D₂ in raising serum 25-hydroxyvitamin D and is more reliably measured in many commercially available assays.

Recommendations

- Higher dose preparations that enable less frequent dosing are likely to be effective, cheaper and have higher adherence. A formulation of 50,000 IU



- (1.25 mg) at monthly or more frequent intervals would have advantages and could be recommended for individuals with vitamin D deficiency.
- Most older people in residential care would benefit from vitamin D supplementation to reduce falls and fractures.
- Vitamin D replacement is safe, even in higher doses up to 600,000 IU (15 mg) per year by intramuscular injection.
- Availability of vitamin D supplements through Section 3 (restricted) (S3R) would minimise the risk of individuals taking a dosage that is higher than optimal. Waiver of S4 registration costs is supported.
- In people with severe deficiency, replacement doses of 5000 to 10,000 IU (125 to 250 µg) per day are often required for up to three months

- to achieve normal vitamin D levels and optimal bone health. A single oral dose of 500,000 IU (12.5 mg) can be given without significant risk of hypercalcaemia or hypercalciuria.
- Reassessment of vitamin D status after three months of therapy may be required by measurement of serum 25-hydroxyvitamin D.

Achieving optimal calcium levels Dietary intake

- Most older women and men are unlikely to meet the provisional RDI (pending approval) of 1300 mg calcium per day without requiring an unrealistically high energy intake or unbalanced diet. (RDIs for calcium are expected to be raised in the near future for males and females of all ages.)



Dairy foods provide protein and micronutrients, in addition to calcium, that may be important for general health, particularly in the frail elderly.



- Individuals at highest risk of inadequate calcium intake are also at highest risk of osteoporotic fracture due to other risk factors, including:
 - elderly age
 - social disadvantage
 - gastrointestinal diseases leading to calcium malabsorption
 - corticosteroid use
 - sex hormone deficiency.
- The period of rapid skeletal growth in children is often a time of inadequate calcium intake.
- Most currently approved treatments for osteoporosis have been evaluated in studies of patients with adequate vitamin D intake and calcium supplementation.

Recommendations

- Dairy foods are a good source of calcium. Low fat options are usually available and are preferable for some individuals.
- Availability of a variety of calcium-fortified foods would improve options to achieve adequate calcium intake.
- Although inadequate calcium intake is likely to be deleterious to bone, calcium intake beyond the recommended level is unlikely to achieve any additional bone health benefit. Thus, strategies to increase calcium intake should be focused on people with the lowest calcium intakes and/or higher demands

(e.g. during the pubertal growth spurt, pregnancy and lactation, after menopause).

- Adequate calcium intake (obtained from dietary or supplement sources) is an essential part of osteoporosis management.

Calcium supplementation

- The effect of calcium supplementation on bone health is modest, as shown by increases in bone density and reductions in excessive bone turnover. The relative risk reduction for osteoporotic fracture is likely not to be more than 10 to 20%.
- There is no significant difference in the absorption of calcium from supplements compared with different dietary sources (excluding foods rich in phytate or oxalate, which are plant-derived compounds that bind calcium).

Recommendations

- Adequate calcium intake should be encouraged in all people, particularly those at high risk of osteoporotic fractures.
- It would seem prudent to encourage a higher calcium intake in the general population through dietary sources, or through supplements when this is not possible.
- Supplements containing calcium in the form of carbonate require gastric acidity for optimal absorption and should therefore be taken with meals. Supplements containing calcium in other forms, such as citrate, do not require gastric acidity.

Other benefits and side effects

- Dairy foods have the advantages of providing protein and other micronutrients, in addition to calcium, that may be important for general health, particularly in the frail elderly.

Vitamin D and Calcium Forum: topics and speakers

Physiology

Calcium and vitamin D physiology – Associate Professor Rebecca Mason

Calcium at all life stages

Pregnancy and lactation – Dr G. Neil Kent

Children and adolescents – Professor Ailsa Goulding

Middle and older years – Associate Professor Allan Need

Therapeutic applications – Associate Professor Richard Prince

Calcium discussion paper – Professor Ian Reid

Vitamin D at all life stages

Pregnancy and babies – Dr Ruth Morley

Children and adolescents – Professor Graeme Jones

Vitamin D deficiency: groups at risk and replacement –
Associate Professor Terry Diamond

Falls and falls prevention – Professor John Wark

Primary and secondary fracture prevention – Professor Philip Sambrook

Sunlight, vitamin D and sun damage – Dr Peter Foley

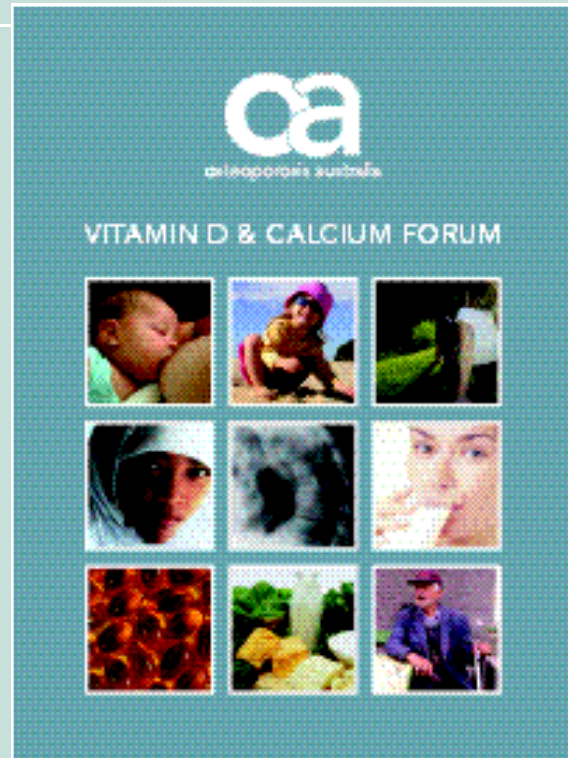
Vitamin D discussion paper – Dr Julie Pasco

Related issues

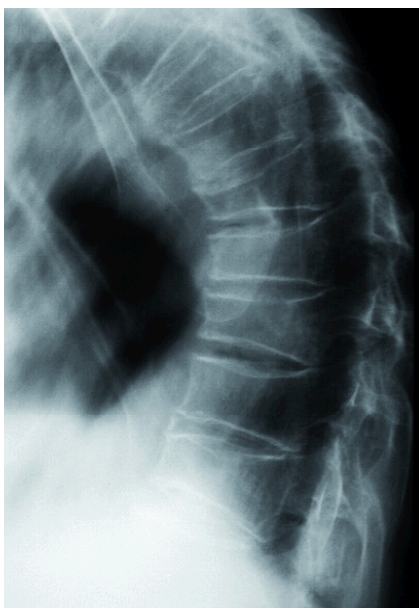
Calcium and vitamin D regulatory and affordability issues –
Professor Geoff Nicholson

Myths, minerals and RDIs – Associate Professor Caryl Nowson

Malabsorption and lactose intolerance – Dr Bob Anderson



- Higher calcium intakes may be beneficial in preventing colonic cancer and hypertension, and in improving lipid profiles.
- There is no evidence of renal calculus disease or other major side effects, apart from some constipation, from



Spinal osteoporotic fractures.

- calcium supplementation.
- Calcium supplementation does not have major effects on the absorption of other micronutrients.

Barriers to adequate calcium nutrition

- Improved dietary calcium intake can be limited by calcium-rich food choices with respect to total energy intake, especially in the elderly.
- Adherence to calcium supplementation is poor, possibly related to individuals suffering from digestive problems or constipation, and the cost of products.

Recommendations

- Availability of a variety of calcium-fortified foods at modest cost is supported by OA and the ANZBMS.
- Increasing cost from any restriction of PBS availability is likely to lead to reductions in the use of calcium supplements, even as recommended.
- Availability of calcium supplements providing 500 to 1000 mg/day at a modest cost is supported. **MT**

Further reading

1. Working Group of the Australian and New Zealand Bone and Mineral Society, Endocrine Society of Australia and Osteoporosis Australia. Vitamin D and adult bone health in Australia and New Zealand: a position statement. *Med J Aust* 2005; 182: 281-284.
2. Chatfield S, Ebeling PR. Osteoporosis prevention and treatment: the importance of vitamin D. *Medicine Today* 2005; 6(4): 16-32.
3. Diamond TH, Ho KWK, Rohl PG, Meerkin M. Annual intramuscular injection of megadosage cholecalciferol for treatment of vitamin D deficiency: efficacy and safety data. *Med J Aust* 2005; 183: 10-12.
4. Ebeling PR. Mega therapy for vitamin D deficiency: treating the paradox of an important emerging public health problem [editorial]. *Med J Aust* 2005; 183: 4-5.
5. Trivedi DP, Doll R, Khaw KT. Effect of four monthly oral vitamin D3 (cholecalciferol) supplementation on fractures and mortality in men and women living in the community: randomised double blind controlled trial. *BMJ* 2003; 326: 469-475.
6. Wu F, Staykova T, Horne A, et al. Efficacy of an oral, 10-day course of high-dose calciferol in correcting vitamin D deficiency. *N Z Med J* 2003 116: U536.

DECLARATIONS OF INTEREST: Declarations are available for all speakers and committee members from Osteoporosis Australia (www.osteoporosis.org.au).