

Low vitamin D in Victoria

Key health messages for doctors, nurses and allied health

Updated June 2017

Vitamin D is essential for musculoskeletal health in all age groups and is likely to be important for other aspects of health.

Low vitamin D is an important public health issue. Mild deficiency affects around one quarter of all Australians. Serum 25-hydroxy vitamin D (25(OH)D) is used to measure vitamin D status. Adequate levels for vitamin D* are considered ≥ 50 nmol/L in adults and children at the end of winter, or 60–70 nmol/l at the end of summer to allow for seasonal decrease.

Classification of Vitamin D (25(OH)D) levels in adults and children

| | |
|---------------------|------------------|
| Adequate | ≥ 50 nmol/L |
| Mild deficiency | 30–49 nmol/L |
| Moderate deficiency | 13–29 nmol/L |
| Severe deficiency | < 13 nmol/L |

Very low vitamin D causes bone and muscle pain and poor bone mineralisation. This can result in rickets in children and osteomalacia in adults.

* Vitamin D is a generic term applied to the two molecules cholecalciferol and ergocalciferol. Cholecalciferol (vitamin D₃) is formed through the action of UVB radiation on 7-dehydrocholesterol in the skin and is currently the only available form of supplement. Ergocalciferol (vitamin D₂) is produced by UVB radiation of the plant steroid ergosterol.

Low vitamin D is also a contributor to osteopenia and osteoporosis.

Appropriate dosages of vitamin D supplements may reduce falls and fractures in older people in residential care.

Low vitamin D levels have been associated with multiple sclerosis, diabetes (type 1 and type 2), various types of cancers (particularly colon cancer), cardiovascular disease, mental health conditions, all-cause mortality, altered immunity, and auto-immune diseases. To date however, a causal relationship has not been established.

The major source of vitamin D is via exposure to the sun's ultraviolet-B (UVB) radiation.

Most Australians obtain just 5–10 per cent of their daily vitamin D requirements from dietary sources. Only a few foods contain vitamin D (for example, some fish, eggs and UV-irradiated mushrooms). Margarine and some types of milk have added vitamin D.

The US recommended dietary allowances (RDA) for vitamin D are 600 IU (15 μ g) daily for age 1–70 years and 800 IU (20 μ g) daily in adults > 70 years. For infants < 1 year, the adequate intake is 400 IU (10 μ g) daily. These RDAs assume minimal sun exposure and are intended to meet or exceed the need of 97.5 per cent of the population.



Groups at risk of low vitamin D

- **People with naturally very dark skin.** The pigment in skin (melanin) acts as a filter to UVB radiation and reduces synthesis of vitamin D in the skin.
- **People with little or no sun exposure.** This group includes:
 - older adults and others who are housebound, hospitalised or institutionalised long term
 - people who wear covering or concealing clothing
 - people who deliberately avoid sun exposure such as those at high risk of skin cancer
 - people with a disability or chronic disease
 - occupations with limited sun exposure (e.g. office workers, taxi drivers, factory workers and night-shift workers).
- **People with medical conditions or medications affecting vitamin D metabolism.** For example, obesity, end-stage liver disease, renal disease, drugs that increase degradation such as rifampicin/anticonvulsants, fat malabsorption syndromes including cystic fibrosis, coeliac disease and inflammatory bowel disease.

- **Breast-fed babies who fall into a risk category above or have mothers with low vitamin D.** Breast milk contains little vitamin D. Infants depend on maternal stores initially (formula milk is fortified with vitamin D) and are at risk of low vitamin D if their mother has low vitamin D and/or if they have naturally very dark skin.

Sun exposure and vitamin D

Most Victorians with fair to olive skin get enough vitamin D through incidental sun exposure in September–April because UV levels are high and more time is spent outdoors.

People who work outdoors: People who work outdoors are at higher risk of skin cancer as they have extended periods of sun exposure. It is unlikely therefore, that vitamin D deficiency is an issue for this professional group.

People who work outdoors for long periods of time may need sun protection all year. A combination of sun protection measures (clothing, sunscreen, broad-brimmed hat, shade and sunglasses) is recommended.

Table 1: Recommended sun exposure to reduce the risk of low vitamin D (Cancer Council Australia, 2016)

| | Fair to olive skin (Fitzpatrick skin types I–IV) Higher risk of skin cancer | Naturally very dark skin (Fitzpatrick skin types V–VI: rarely or never burns) Higher risk of low vitamin D |
|---|---|--|
| From September to April – when average daily UV levels are 3 and above | A few minutes of mid-morning or mid-afternoon sun exposure each day to arms and hands (or equivalent area of skin) being extra cautious in the middle of the day when UV levels are most intense. | A few minutes of mid-morning or mid-afternoon sun exposure each day to arms and hands (or equivalent area of skin) being extra cautious in the middle of the day when UV levels are most intense. It may not be possible to maintain vitamin D levels through sun exposure alone and supplementation may be required. |
| | A combination of sun protection measures (clothing, sunscreen, broad-brimmed hat, shade and sunglasses) is recommended when outdoors for more than a few minutes. | A combination of sun protection measures (clothing, sunscreen, broad-brimmed hat, shade and sunglasses) is recommended when outdoors for more than a few minutes, even for those diagnosed with vitamin D deficiency. |
| From May to August – when average daily UV levels are below 3 | Spend time outdoors in the middle of the day with some skin uncovered on most days of the week. | It may not be possible to maintain vitamin D levels through sun exposure alone and supplementation may be required. |
| | Sun protection (with the exception of sunglasses) is not needed unless in alpine regions, outside for extended periods or near highly reflective surfaces such as snow or water. | Sun protection (with the exception of sunglasses) is not needed unless in alpine regions, outside for extended periods or near highly reflective surfaces such as snow or water. |

25-hydroxy vitamin D testing and treatment

- **Routine** screening for vitamin D is **not** recommended. **Test adults and children with risk factors for low vitamin D¹**. Include pregnant or lactating women with risk factors and their children.
- **Vitamin D production fluctuates seasonally**, decreasing in cooler months when UV levels are lower, more time is spent indoors and more covering clothing is worn.
- **Treat if 25(OH)D levels < 50 nmol/L**. Serum 25(OH)D levels should be maintained at 50 nmol/L or more at the end of winter or early spring in the general population and at 75 nmol/L or more in people diagnosed with osteoporosis.
- **Vitamin D supplements can either be low dose (given daily) or high dose form** (given monthly or less often). High dose vitamin D should not be used during pregnancy or lactation, or in very young children. High dose vitamin D is becoming more widely available, but may have adverse effects and may not be as effective as daily doses. Asymptomatic vitamin D deficiency does not need to be corrected rapidly.
- **Once supplementation has commenced wait at least 3 months** before checking serum 25(OH)D concentrations again. This allows it to reach a steady state.
- **Cod liver oil capsules are not suitable for vitamin D replacement**, as they typically contain 60–85 IU (1.5–2.1 µg) of vitamin D₃ per capsule but 8–10 times more vitamin A per capsule. The number of capsules required to provide adequate daily vitamin D would exceed the recommended daily intake for vitamin A and may lead to toxicity (including fractures).
- **It is not recommended to prescribe a single dose of more than 50,000 IU (1.25 mg) vitamin D for adults**. Contraindications to high dose vitamin D include hypercalcaemia and kidney disease.
- **Breast fed babies with risk factors for low vitamin D should be supplemented** with 400 IU (10 µg) vitamin D daily (for example, in infant multi-vitamin drops) from birth until at least 12 months.
- **Adequate dietary calcium** is important at all ages. People may need calcium supplements if their dietary intake is poor.
- **Low vitamin D is a long-term problem for at risk people**. Once low vitamin D is treated the aim is to maintain normal vitamin D levels. People with risk factors for low vitamin D should have their levels checked every year once normal levels are achieved, and may need lifelong supplements.
- **Solariums are illegal in Victoria and should never be used** to boost vitamin D as they emit dangerous levels of UV that increases the risk of skin cancer.
- **Information on follow-up** should be incorporated into GP software management programs to ensure recall/reminders occur.

Table 2: Adult dosing schedule (adapted from: Therapeutic Guidelines, Endocrinology, Version 5, 2014)

| 25(OH)D level nmol/L ² | ADULT alternative dosing regimens | |
|--------------------------------------|---|---|
| | Daily dose oral vitamin D ₃ ³ | High dose regimen oral vitamin D ₃ ^{3,4} |
| 30–49 (mild deficiency) | 1,000–2,000 IU (25–50 µg) daily | |
| < 30 (moderate to severe deficiency) | Initially 3,000–5,000 IU (75–125 µg) daily for at least 6–12 weeks Recheck level after 3 months. If 30–49 nmol/L, change to therapy for mild deficiency | 50,000 IU (1.25 mg) once a month for 3 to 6 months Recheck level after 3 months. If 30–49 nmol/L, change to therapy for mild deficiency |

Note: These recommendations are current as of 2017 but may be subject to change. Please refer to “Therapeutic Guidelines, Endocrinology” at <https://tgldcdp.tg.org.au/etgcomplete>.

Notes

- 1 Blood test for 25(OH)D levels should be performed by a reputable laboratory participating in the Vitamin D External Quality Assessment Scheme.
- 2 Seasonal variation occurs with vitamin D, the lowest levels being in late winter and early spring.
- 3 Total calcium intake of 1,000–1,300 mg per day is also recommended.
- 4 Not readily available in Australia. Medical practitioner can obtain TGA authorisation to treat patient with high-dose vitamin D. Alternatively the practitioner may write a private prescription for a compounding pharmacy.

Table 3: Paediatric dosing schedule (adapted from: Clinical Practice Guidelines: Vitamin D deficiency, Royal Children's Hospital Melbourne)

| 25(OH)D level (nmol/L) | Treatment oral vitamin D ₃ | Maintenance/prevention in children with ongoing risk factors (oral vitamin D ₃) |
|---|--|---|
| Preterm | | |
| 30–49 | 200 IU (5 µg)/kg daily, maximum 400 IU (10 µg) daily | 200 IU (5 µg)/kg daily, maximum 400 IU (10 µg) daily |
| < 30 | 800 IU (20 µg) daily, review after 1 month | 200 IU (5 µg) daily, maximum 400 IU (10 µg) daily |
| Neonates – young infants (age < 3 months) | | |
| 30–49 | 400 IU (10 µg) daily for 3 months | 400 IU (10 µg) daily |
| < 30 | 1,000 IU (25 µg) daily for 3 months | 400 IU (10 µg) daily |
| Infants (age 3–12 months) | | |
| 30–49 | 400 IU (10 µg) daily for 3 months | 400 IU (10 µg) daily |
| < 30 | 1,000 IU (25 µg) daily for 3 months or 50,000 IU (1.25 mg) stat and review after 1 month | 400 IU (10 µg) daily |
| Children and adolescents (age 1–18 years) | | |
| 30–49 | 1,000–2,000 IU (25–50 µg) daily for 3 months or 150,000 IU (3.75 mg) stat | 400 IU (10 µg) daily or 150,000 IU (3.75 mg) at the start of Autumn |
| < 30 | 1,000–2,000 IU (25–50 µg) daily for 6 months or 3,000–4,000 IU daily for 3 months or 150,000 IU (3.75 mg) stat and repeat at 6 weeks | |

Note: These recommendations are current as of 2017 but may be subject to change. Please refer to the Clinical Practice Guidelines: Vitamin D deficiency, Royal Children's Hospital Melbourne at http://www.rch.org.au/clinicalguide/guideline_index/Vitamin_D_deficiency/

For pregnant women with levels 30–49 nmol/L, commence 1,000 IU (25 µg)/day. Pregnant women with levels < 30 nmol/L should commence 2,000 IU (50 µg)/day; repeat levels at 28 weeks gestation.

For breastfeeding women, aim for normal levels during pregnancy, then continue on 1,000 IU (25 µg)/daily during breastfeeding. Consider neonatal supplements in babies with risk factors for low vitamin D.

Infants on full formula feeds should receive adequate vitamin D from this source.

Children with low calcium, low phosphate or clinical rickets require urgent specialist assessment and further investigations.

Follow-up blood tests in children include 25(OH)D, ALP, Ca, PO₄. **In moderate to severe deficiency, repeat bloods three months after initial treatment (one months in infants).** Further treatment may be required. In mild deficiency, it is usually not necessary to recheck for response to treatment.

In children with ongoing risk factors, annual testing is recommended. More frequent testing should be avoided.

Treatment and maintenance doses are intended to ensure 25(OH)D levels ≥ 50 nmol/L.

Acknowledgements

The document is based on information generated from the following resources:

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