



FACT SHEET

VITAMIN D

Vitamin D has recently resurfaced as an important at risk nutrient in Australia with the re-emergence of deficiency in certain population groups and areas. It is a fat soluble vitamin and is the generic term for 2 molecules – ergocalciferol (Vitamin D₂) and cholecalciferol (vitamin D₃). *Ergocalciferol (D₂)* is the form of vitamin D used in supplements and is produced by UV radiation of yeasts and fungi. *Cholecalciferol (D₃)* is formed in humans and animals through the action of UV light on the skin. The metabolically active forms, *calcitriol* and *ergocalcitrinol* are produced by the kidney, and function as hormones with the intestine and bone target organs.

Functions:

- Promotes the absorption of calcium and phosphorous and help deposit them in bones and teeth to make them stronger
- Maintains serum calcium and phosphorous levels – calcium levels must be maintained to sustain work of the heart, muscle contraction, blood clotting
- Enhances the immune system and reduces susceptibility to infection
- Vitamin D has an important role in skin cells such as melanocyte and fibroblasts
- Has a direct effect on skeletal muscle, influencing muscle strength
- May have some direct role in enhancing insulin response and reducing insulin resistance in diabetes

Sources:

- Sunlight is the best source of vitamin D and the major source of vitamin D for most of the population. The amount of vitamin D produced varies with the skin colour (the darker the skin the less vitamin D produced), angle of the sun, (less in winter than in summer), increasing age (decreased ability to produce Vitamin D due to less precursor and less activation of precursor) and the use of sunscreens
- Food is generally a poor source. Sources include fatty fish (herring, mackerel, salmon, sardines), butter, cheese, eggs, infant formula, meat, and fortified foods such as margarine and some milk products. eg toddler milks
- Breast milk is a poor source of vitamin D. The vitamin D status of the breast fed infant is directly related to the mother's vitamin D status during pregnancy. Infants build up their stores from mum via the placenta and are born with approximately 9 months supply provided the mother has obtained adequate vitamin D during pregnancy.

Metabolism of Vitamin D

- Sunlight converts 7 dehydro-cholesterol in the skin to cholecalciferol (vitamin D₃). Once formed cholecalciferol is taken via blood to the liver where it is converted into 25 hydroxy cholecalciferol (25(OH)D₃). The blood level is dependent on food intake and exposure to sun and is used to measure vitamin D status.
- The most potent form is calcitriol or 1,25 hydroxy cholecalciferol (1,25(OH)₂D₃) which is formed in the kidneys. It increases calcium and phosphorus uptake in the intestine by increasing their absorption, and on bone to increase mobilization. Its synthesis depends on serum levels of calcium and phosphorous. Parathyroid hormone (PTH) stimulates the production of calcitriol when serum calcium is low. When serum calcium and phosphorous levels fall, PTH is released to conserve calcium and initiate breakdown of bone. When calcium is high, calcium is absorbed by passive diffusion across the gut wall by diffusion without vitamin D.
- Vitamin D does not remain in the blood stream for very long but is taken up in adipose tissue for storage or to the liver for further activation.

Recommended Dietary Intakes.

- There is no RDI for vitamin D in Australia as it was assumed that most Australians would get adequate vitamin D through sunlight. This is currently under review by the the



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National Health and Medical Research Council. Adequate sunlight is recommended for pregnant women and a supplement of 10ug/day for the elderly if they are not exposed to 1-2 hours of sun /week.

- In the USA the Daily Reference Intake for 0-50 years is 5ug/day.
- In general, exposure of hands, face and arms to 5- 15 minutes of sunlight 2 to 3 times per week should provide adequate vitamin D.
- Standard 2.9.1 Infant Formula regulates the maximum and minimum levels of vitamin D in formulas -0.25ug/100kJ min – max 0.63ug/100kJ
- Toddler Milks are permitted to contain up to 2.5ug or 50% RDI per serve. In the Australian Food Standards Code the RDI is given as 5ug.

Deficiency

- Characterised by normal serum calcium, increased Parathyroid hormone (PTH) and alkaline phosphatase and low or low to normal phosphorous.
- Commonly seen in the elderly and now arising in dark skinned, veiled and unveiled women during pregnancy (especially immigrants from Sudan, India, Egypt, Somalia, Lebanon, Ethiopia, Zaire, Pakistan, Kenya, Turkey, Iraq, Sri Lanka) and their breast fed infants and children.
- Vitamin D stores in the infant are dependent on the placental transfer of vitamin D from mother to foetus. If mother's intake is low, the foetus stores will be low, and the infant born with low stores. Breast milk is a poor source of vitamin D. This combined with low stores and restricted exposure to sunlight puts the infant at risk.
- Rickets are a sign of deficiency in children. Bones are malformed because of poor mineralization and are unable to cope with the normal stresses and strains placed on them. The result is bow legs and knock knees and short stature. Other presenting signs of deficiency are delayed walking, seizures, failure to thrive, bone pain, stiff hips
- Osteomalacia – seen in adults and common in women of childbearing age because of multiple pregnancies, inadequate diet and exposure to sun. Bones soften and are weak and painful.
- Screening is recommended for those at risk of deficiency and appropriate supplementation as a preventative and treatment measure when required

Excess

- Not caused by sunlight but excess oral intake eg excess cod liver oil
- Hypercalcaemia – excessive calcification of bone, soft tissues such as kidney, lungs and tympanic membrane causing deafness, headache, nausea
- Infants and children experience gastrointestinal upsets, retarded growth, mental retardation
- Daily vitamin D intakes should not exceed 50ug (2000 IU) for adults and 25ug (1000 IU) infants

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