

## Vitamin D

**Conversions for Vitamin D3:**  
Sources: 40 IU = 1 µg  
[serum]: 2.5 nmol/L = 1 ng/mL

### Supplement Overview

- > Vitamin D is classified as a fat soluble vitamin which acts functionally as a hormone and has a structure that is similar to steroid hormones.
- > There are 2 different isoforms of Vitamin D: D3 (cholecalciferol) which is the important isomer formed in human skin and D2 (ergocalciferol) which is the plant-derived equivalent. D2 was the first isoform to be characterised and was first used in Vitamin D supplements and for food fortification. D3 is now considered preferable. D3 is biologically inert until converted in the liver to 25(OH)D and to 1,25(OH)D in the kidney.
- > Vitamin D plays an important role in calcium and phosphorous homeostasis (bone health), gene expression and cell growth. The recent recognition of Vitamin D receptors in most body tissues indicates a role for Vitamin D in many aspects of health and function. Vitamin D is now known to be important for optimal muscle function.
- > The principal source of circulating vitamin D comes from exposure to ultraviolet B (UVB) radiation from sunlight.
- > In 2010, the Institute of Medicine issued new Dietary Reference Intakes for Vitamin D, assuming no sunlight exposure: this included a Recommended Dietary Intake of 600 IU/d and an Upper Level intake of 4000 IU/d ([www.iom.edu/vitamind](http://www.iom.edu/vitamind)).
- > Vitamin D deficiency can lead to several health issues including increased risk of bone injuries, chronic musculoskeletal pain and viral respiratory tract infections.
- > There is also emerging evidence that supplementing Vitamin D in athletes with sub-optimal Vitamin D levels may have beneficial effects on athletic performance in particular strength, power, reaction time and balance.
- > There is no universally accepted definition of vitamin D deficiency however, the following definitions based on serum levels of 25(OH) Vitamin D are often cited:
  - Vitamin D deficiency: serum levels < 20 ng/ml (50 nmol/L)
  - Vitamin D insufficiency: serum levels < 30 ng/ml (75 nmol/L)
  - Vitamin D sufficiency: serum levels > 30 ng/ml (75 nmol/L)
  - Ideal Vitamin D range\*: 75-120 nmol/L
  - Toxicity: > 375 nmol/L when combined with raised serum calcium(\*Higher status may be preferred for athletes to allow a greater safety margin and to optimize performance; some agencies working with elite athletes often set their own thresholds for desired Vitamin D concentrations)
- > Several recent studies have shown low levels of vitamin D among athletes (Lovell 2008, Willis et al 2008, Cannell et al 2009).

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- Athletes at risk of Vitamin D deficiency include those who:
  - Have low exposure to sun in training environment (e.g. training indoors or in early morning and late afternoon)
  - have dark skin pigmentation
  - live at latitudes > 35 degrees north or south of the equator [Brisbane = 27 degrees, Perth = 32 degrees, Sydney = 34 degrees, Adelaide and Canberra = 35 degrees, Melbourne = 38 degrees, Hobart = 42 degrees)
  - wear clothing that covers most or all of their body
  - regularly use sunscreen or consciously avoid the sun
  - are missing limbs (e.g. many athletes with disability)
  - have gastrointestinal malabsorption (e.g. Coeliac disease or fat malabsorption)
  - have a family history of bone injury/disorders or Vitamin D deficiency

### Sources of Vitamin D

- The principal source of Vitamin D comes from exposure to ultraviolet B (UVB) radiation from sunlight (see Table).

#### Regional recommendations for sun exposure times

Region	Summer	Winter	
	10am or 2pm	10am or 2pm	12 noon
Northern Australia (e.g. Cairns)	6-7 min	9-12 min	7 min
Central Australia (e.g. Brisbane)	6-7 min	15-19 min	11 min
Southern Australia			
➤ Sydney	6-8 min	26-28 min	16 min
➤ Melbourne	6-8 min	32-52 min	25 min
➤ Hobart	7-9 min	40-47 min	29 min

*Adapted from: Vitamin D and Adult Bone Health in Australia and New Zealand: A Position Statement: MJA, 2005.*

- Small amounts of vitamin D can be found in foods such as oily fish, egg yolks and fortified foods such as milk, orange juice, cereals and margarine. However, even Vitamin-D rich food sources generally provide ~ 40-150 IU per serve and will not meet Vitamin D requirements.

### Supplement Profile

- Vitamin D supplements are available for oral intake and intramuscular therapy. Vitamin D3 is the preferable supplement form.

### Situations for Use in Sport

- Athletes who are tested and found to have low levels of vitamin D. At the AIS, this is defined as serum 25(OH) Vitamin D < 75 nmol/L (32 ng/ml).

### Concerns Associated with Supplement Use

- Over-exposure to UVB (natural sunlight or tanning beds) in an effort to increase vitamin D levels are not recommended as it can lead to sunburn and melanoma.
- There is some concern, but also dispute, about the level of Vitamin D supplementation that is considered excessive and associated with symptoms of toxicity.

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### Further reading

Cannell, JJ; Hollis, BW; Sorenson, MB; Taft, TN and Anderson, JJB. Athletic performance and vitamin D. *Med Sci Sports Exerc.* 2009; 41(5): 1102-1110

Dietary Reference Intakes for Calcium and Vitamin D. Institute of Medicine, National Academy of Science: Washington, USA, 2011

Lovell, G. Vitamin D status of females in an elite gymnastics program. *Clin J Sport Med.* 2008; 18(2): 159-161.

National Health and Medical Research Council. Nutrient reference values for Australia and New Zealand: Vitamin D. 2005.

Willis, KS, Peterson, NJ and Larson-Meyer, DE. Should we be concerned about the vitamin D status of athletes? *Int J Sport Nutr Exerc Metab.* 2008; 18: 204-224

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. *MJA.* 2005; 182(6): 281-285

This Fact Sheet was prepared by AIS Sports Nutrition as part of the Sports Supplement Framework ([www.ausport.gov.au/ais/nutrition/supplements](http://www.ausport.gov.au/ais/nutrition/supplements)). Note that a Fact Sheet with additional information on this topic is available for Members of the Sports Supplement Framework via the Clearinghouse.

The Sports Supplement Framework has been designed to provide a framework for NSO athletes and specific Sports Supplement Programs may be available to NSO athletes through their NSO. All attempts are made to stay abreast of scientific knowledge and of WADA issues related to anti-doping. It is recommended that other athletes and groups should seek independent advice before using any supplement, and that all athletes consult the WADA List of Prohibited Substances and Methods before making decisions about the use of supplement products.

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Last updated May 2014