

PREVENTION OF VITAMIN D DEFICIENCY

Vitamin D deficiency remains a hot topic and GPs can play a vital role in ensuring the patient population meets the recommended levels

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New proposed recommendations

Currently vitamin D supplements for preventing deficiency are only recommended for at risk groups (Table 1). But last year the Scientific Advisory Committee on Nutrition (SACN) completed a review of the evidence and the prevalence of vitamin D deficiency among the general population in the UK, and subsequently proposed a Recommended Nutrient Intake (RNI) of 10µg/day for the whole population over 12 months of age (SACN, 2015).¹ When these recommendations are finalised in the next few months and sent to the Department of Health, policy will probably change to a recommendation of a supplement of 10µg/day for the whole population over 1 year of age. For infants an intake of 8.5-10 µg/day is likely to be recommended. This would mean a supplement from birth for breastfed infants as breastmilk does not contain this amount.

Why are supplements necessary for the general population?

In the UK a healthy, balanced diet provides all the nutrients needed except vitamin D, as few foods naturally contain it. Only oily fish is a significant source, while egg yolks, meat and a few fortified foods provide small amounts. Other foods contain no vitamin D or negligible amounts and most of the population consume less than 3µg of vitamin D per day.²

Fortified foods in the UK include:

- Margarine – fortification has been a legal requirement since World War II
- Formula milks – infant formulas, follow-on formulas and growing up milks
- Fortified milks – evaporated milk and fortified milks for toddlers e.g. Arla Big milk
- A few breakfast cereals
- Some brands of yogurts.

In other countries, such as Finland, Canada and the USA, a wider range of commonly consumed foods are fortified with vitamin D, such as fresh cows' milk, other dairy products and some fruit juices.

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early in life, although rare, results from low fetal stores due to maternal vitamin D deficiency.

Dermal synthesis of pre-vitamin D is the main source of vitamin D, but is unreliable in the UK. Light of the critical wavelength for synthesis cannot pass through glass and the ideal time to spend outside each day is not easy to define as synthesis depends on:

- **Season** – sunlight of the critical wave length only reaches the UK between April and September. It is absorbed by the atmosphere during winter months.
- **Latitude** – in the south of the UK there is more sunlight of the critical wavelength than the north.
- **Weather** – more vitamin D can be synthesised on bright sunny days than on cloudy days.
- **Air pollution** – reduces the critical UV light waves available for skin synthesis.
- **Time of day** – more vitamin D is synthesised when sunlight is most intense in the middle of the day compared to early morning and late afternoon.
- **Colour of skin** – darker skins require more time in the sun to synthesise the same amount of vitamin D as light skins.³ Those of Asian, African and Middle Eastern ethnic origin are more likely to have lower vitamin D levels than Caucasians.
- **Lifestyle** – time spent outside with bare skin exposed facilitates vitamin D synthesis, which is greatly diminished when most skin is covered by clothes, as can be the fashion or in the case in girls and women with certain religious and cultural traditions.
- **Sunscreen use** – It blocks dermal synthesis of vitamin D.

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Vitamin D excess as a result of excessive sunshine exposure does not occur as synthesis is inhibited when sufficient levels are achieved.⁴

Vitamin D deficiency in the UK

Low serum levels of vitamin D are found in significant numbers of all population groups in the UK: in winter 30-40% of all age groups in the general population are classed as vitamin D deficient. Even towards the end of summer 8% of adults and 13% of adolescents remain deficient.²

Classification	Serum 25-hydroxy vitamin D (nmols/l)
Deficiency	<25
Insufficiency:	25-50
Sufficiency:	50-125

Deficiency is usually accompanied by normal blood levels for calcium and phosphorus, high-normal or elevated levels of parathyroid hormone (PTH), normal to elevated levels of total alkaline phosphatase, a low 24-hour urine calcium excretion rate, and low levels of total 25(OH)D. Patients with severe and long-standing vitamin D deficiency may present with overt hypocalcemia and/or hypophosphatemia, but this is the exception.

Vitamin D excess as a result of excessive sunshine exposure does not occur as synthesis is inhibited when sufficient levels are achieved

Consequences of vitamin D deficiency

The role of vitamin D in bone health is well defined; it promotes calcium absorption in the gut and maintains adequate serum calcium and phosphate concentrations to enable normal mineralization of bone and teeth and to prevent hypocalcaemic tetany. It is also needed for bone growth and bone remodelling by osteoblasts and osteoclasts.⁴ Without sufficient vitamin D, bones can become thin, brittle or misshapen and clinical manifestations are:

- Hypocalcaemic seizures due to low blood calcium levels – seen in young infants as a result of maternal vitamin D deficiency during pregnancy
- Rickets in growing children
- Osteomalacia in adults
- Osteoporosis in older adults.

Other roles of vitamin D are less well defined but epidemiological evidence strongly suggests it plays a role in growth, muscle strength, prevention of falls in the elderly and in decreasing the risk of cardiovascular disease, inflammatory and autoimmune diseases, some cancers and other chronic diseases^{1,4} such as:

Consensus vitamin D position statement

This represents the unified views of the British Association of Dermatologists, Cancer Research UK, Diabetes UK, the Multiple Sclerosis Society, the National Heart Forum, the National Osteoporosis Society and the Primary Care Dermatology Society.

Vitamin D is essential for good bone health and for most people sunlight is the most important source of vitamin D. The time required to make sufficient vitamin D varies according to a number of environmental, physical and personal factors, but is typically short and less than the amount of time needed for skin to redden and burn. Enjoying the sun safely, while taking care not to burn, can help to provide the benefits of vitamin D without unduly raising the risk of skin cancer. Vitamin D supplements and specific foods can help to maintain sufficient levels of vitamin D, particularly in people at risk of deficiency. However, there is still a lot of uncertainty around what levels qualify as “optimal” or “sufficient”, how much sunlight different people need to achieve a given level of vitamin D, whether vitamin D protects against chronic diseases such as cancer, heart disease and diabetes, and the benefits and risks of widespread supplementation.

- Type 1 and 2 diabetes
- Allergy
- Upper respiratory tract infections and wheeze including asthma
- Infectious diseases
- Multiple sclerosis
- Rheumatoid arthritis
- Dementia.

Low vitamin D levels are also associated with severe pre-eclampsia in pregnant women.^{5,6}

Vitamin D: vitamin or hormone?

The ultraviolet rays of wave length 290-315nm convert 7-dehydrocholesterol in the skin to pre-vitamin D. This is metabolized in the liver to 25-hydroxyvitamin D (calcidiol), which is a stable metabolite with a half-life of 2-3 weeks. It is converted in the kidney and select other tissues by the action of the 1 α -hydroxylase enzyme to 1,25-di-hydroxyvitamin D (calcitriol), the active form which interacts with vitamin D receptors found in all cells. Hence, vitamin D could be more accurately called a steroid hormone.

It is fat-soluble and stored in adipose tissue or fat deposits when dermal synthesis and dietary intakes exceed daily requirements. Stores are used during the winter months when the critical wavelength in sunlight is insufficient for dermal synthesis.

The skin cancer vs dermal vitamin D synthesis debate

Concern over the balance between having sufficient sun exposure to produce vitamin D, and over-exposure leading to burning of the skin and an increased risk of skin cancer, has led to confusion of public health messages. To provide balanced, evidence-based advice

a consensus statement on vitamin D was produced by several organisations with concerns in this area,⁷ which NICE has endorsed in its latest guidance NG34 Sunlight exposure: risks and benefits.⁸

Current recommendations on supplementation for at risk populations

Dietary recommendations for vitamin D intake for children over three years of age and most adults were not set in 1991, as it was expected that dermal synthesis of vitamin D would suffice. However, the National Diet and Nutrition surveys (NDNS) show that few at risk population groups in the UK meet their RNI for vitamin D through food alone, and will only attain their dietary RNI when taking a vitamin D supplement.²

In addition, other groups who are defined as at risk of vitamin D deficiency due to certain clinical conditions are children and adults who:

- are obese
- have gastrointestinal malabsorption
- have kidney or liver disease
- are on certain medications, such as statins.

TABLE 1: CURRENT RECOMMENDATIONS ON VITAMIN D SUPPLEMENTATION IN THE UK⁹⁻¹¹

	Recommended daily supplement	
	µg	International Units
Pregnant and breastfeeding women	10	400
Breastfed infants from 6 months or from 1 month if the mother’s nutritional status during pregnancy is in doubt	7.5	300
Formula-fed infants who are drinking less than 500mls formula milk/day	7.5	300
Toddlers 1-4 years	7.5	300
Preterm infants	A vitamin supplement that includes vitamin D is usually prescribed	
Adults over 64 years	10	400
■ to maintain muscle strength and bone mineralisation despite the decreasing efficiency of skin to make vitamin D that occurs with aging		
Other at risk groups:	10	400
1. those with darker skin e.g. people of African, African-Caribbean or South Asian family origin		
2. people who have low or no exposure to the sun, e.g. those who cover their skin for cultural reasons, who are housebound or confined indoors for long periods		

The role for GP surgeries in preventing vitamin D deficiency

The recommendations in NICE Public Health Guidance 56 *Vitamin D: increasing supplement use among at-risk group*, published in 2014, which specifically apply to CCGs, GP practice staff and local authorities are to:

- Ensure all health professionals recommend vitamin D supplements
- Increase access to vitamin D supplements
- Increase local availability of vitamin D supplements for at-risk groups
- Improve access to Healthy Start supplements (which could include GP practices stocking and distributing them either from the practice or a nearby pharmacy)
- Only test vitamin D status if someone has symptoms of deficiency or is at very high risk
- Raise awareness among health, social care and other relevant practitioners of the importance of vitamin D
- Raise awareness of the importance of vitamin D supplements among the local population
- Monitor and evaluate the provision and uptake of vitamin D supplements
- Develop national activities to increase awareness about vitamin D
- Ensure a consistent multiagency approach.¹¹

Vitamin D supplements for prevention of vitamin D deficiency

The two main forms of vitamin D are:

- Vitamin D₃ (cholecalciferol) produced by dermal synthesis and provided by the few foods and most vitamin supplements
- Vitamin D₂ (ergocalciferol) provided by some supplements and found in very small amounts in mushrooms.

Both forms are metabolised in the same way, but the 25 hydroxyvitamin D₃ has a longer half-life than 25 hydroxyvitamin D₂. Hence supplements of vitamin D₃ are considered more beneficial than supplements of vitamin D₂.

The National Diet and Nutrition surveys (NDNS) show that few at risk population groups in the UK meet their RNI for vitamin D through food alone

The Healthy Start supplements

English CCGs and local authorities and Scottish health boards are required to provide them free of charge to the beneficiaries of the Healthy Start scheme and sell them at a fixed price to other clients. Unfortunately, availability of these supplements varies and in some areas they are only available in some NHS clinics but are not for sale to non-beneficiaries of the Healthy Start scheme. GP surgeries could stock and distribute or sell them to patients. The supplements can be ordered from NHS supply chain. More information can be found on the Healthy Start website: <http://www.healthystart.nhs.uk/for-health-professionals/vitamins>. The Chief Medical Officer is considering making them universally free to all pregnant and breastfeeding women and children under five.¹²

TABLE 2: VITAMIN D SUPPLEMENTS FOR PREVENTION OF DEFICIENCY

Brand	Products	Daily Dose (µg)	Cost
Healthy Start (HS) Supplements			
NHS Healthy Start	Children's vitamin drops	7.5	£2.10 / 2 months or free to HS beneficiaries
	Women's vitamin tablets	10	£1.15 / 2 months or free to HS beneficiaries
Over the counter supplements with reliable quality control			
Boots	Baby and Toddler Vitamin D drops	7.5	£5.49 / 23 days
	Vitamin D tablets	10	£2.19 / 3 months
Colief	Vitamin D3 drops	8 or 10	£9.99 / 4-5 months
Ddrops	Baby Ddrops	7.5	£9.99 / 2 months
	Mum's Ddrops	10	£11.99 / 2 months
	Liquid vitamin D3 25mcg	25	£20.99 / 6 months
HealthAid	Babyvit-D	10	£9.99 / 3 months
Vitabiotics	Wellbaby vitamin D drops	8.5	£4.95 / 2 months
	Ultra vitamin D	25	£5.10 / 3 months
Licensed vitamin D supplements for prevention on prescription			
Meda	Desunin capsules 800IU	20	£3.40 / 30days
Internis	Fultium D3 drops	10	£10.70 / 5 months
	Fultium D3 800IU capsules	10	
Consilient	InVita D3 2,400 IU/ml oral drops	10	£4.45 / 18 days

Unit Conversion factors for Vitamin D:

Concentration in blood: 2.5nmol/l = 1ng /litre.
Amounts in food and supplements: 1µg vitamin D = 40 International Unit (IU)

Over the counter supplements

Both tablet and liquid form are available in pharmacies and supermarkets. Patients should be advised to buy Vitamin D3 supplements from brands sold in pharmacies as these have reliable quality control standards, e.g. Baby D, Boots, Colief, HealthAid, Vitabiotics, Wellkid.

Low serum levels of vitamin D are found in significant numbers of all population groups in the UK

Most multi vitamin supplements for infants, children, adults and pregnant and breastfeeding women sold in the UK include vitamin D along with other vitamins, but the vitamin D content varies and may not meet the recommendation.

Prescription supplements

Three brands of vitamin D only supplements (Desunin, Fultium and InVita) are licensed for prevention (Table 2).

KEY POINTS

- 1 Department of Health policy on vitamin D supplementation is likely to change in the near future to recommending supplementation for the whole population
- 2 NICE PHG56¹² requires health professionals to raise awareness of the need for vitamin D supplementation and to make suitable supplements accessible
- 3 GP surgeries or a nearby pharmacy could stock and distribute/sell the Healthy Start supplements which contain vitamin D
- 4 In the UK a healthy, balanced diet provides all the nutrients needed except vitamin D as oily fish is the only significant food source
- 5 Dermal synthesis from skin exposure to sunlight during the summer months is not a reliable source for everyone
- 6 Over the counter supplements are now widely available
- 7 Vitamin D3 supplements are superior to Vitamin D2 supplements

Safety concerns

Excess vitamin D taken as supplements could have detrimental effects on health.

The European tolerable upper intake levels of vitamin D are:

- infants 0-12 months: 25ug (1000IU)/day
- children 1-10 years: 50ug (2000IU)/day
- older children and adults: 100ug/day (4000IU)/day.¹³

Treating diagnosed vitamin D deficiency

Prescription supplements of high doses for the treatment of diagnosed vitamin D deficiency are listed in the BNF and BNFC. Some NHS areas have treatment protocols to follow.

Judy More works freelance and is a member on the Colief Expert Panel.

References

1. Scientific Advisory Committee on Nutrition (2015) <https://www.gov.uk/government/consultations/consultation-on-draft-sacn-vitamin-d-and-health-report>
2. Public Health England and Food Standards Agency (2014) <https://www.gov.uk/government/statistics/national-diet-and-nutrition-survey-results-from-years-1-to-4-combined-of-the-rolling-programme-for-2008-and-2009-to-2011-and-2012>
3. Clemens TL, Henderson SL, Adams JS, Holick MF. *Lancet* 1982; 1(8263): 74-76
4. Holick MF. *J Investig Med*. 2011;59(6):872-80
5. Dror DK. *Curr Opin Obstet Gynecol*. 2011 Dec;23(6):422-6.
6. Bodnar LM, Catov JM, Hyagriv NS, et al. *J Clin Endocrinol Metab* 2007;92:3517e22.
7. Cancer Research UK (2010) http://info.cancerresearchuk.org/prod_consump/groups/cr_common/@nre/@sun/documents/generalcontent/cr_052628.pdf
8. National Institute for Health and Care Excellence (2016) Nice Guidance 34 Sunlight Exposure: Benefits and Risks <https://www.nice.org.uk/guidance/ng34>
9. Department of Health (2012) Letter from Chief Medical Officer to Healthcare Professionals: Vitamin D: Advice for at risk groups
10. Department of Health (1998) The Stationery Office, London.
11. National Institute for Health and Care Excellence (2014) <https://www.nice.org.uk/guidance/ph56>
12. National Institute for Health and Care Excellence (2015) <https://www.nice.org.uk/article/pmg25/chapter/Executive-summary>
13. EFSA (2012) *EFSA Journal* 2012;10(7):2813 [45 pp.]. doi: 10.2903/j.efsa.2012.2813

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