



GUIDE FOR VITAMIN D IN CHILDHOOD

October 2013

RCPCH

Royal College of
Paediatrics and Child Health

Leading the way in Children's Health

Introduction

There are many different recommendations for the prevention, detection and treatment of Vitamin D deficiency in the UK. The following is a practical interim guide laid out for paediatricians and their teams. The guide will be developed and updated when other bodies such as the Scientific Advisory Committee on Nutrition, the National Institute for Health and Care Excellence, the National Osteoporosis Society and the British Paediatric and Adolescent Bone Group evaluate research and publish their consensus opinions.

What is Vitamin D?

Vitamin D is an essential nutrient needed for healthy bones, and to control the amount of Calcium in our blood. There is recent evidence that it may prevent many other diseases.



What is the natural source of Vitamin D?

Most people get little Vitamin D in their diet. Only a few natural foods such as oily fish and eggs (20 – 40 units per egg) contain significant amounts of Vitamin D. A few foods are fortified with small amounts of Vitamin D (eg margarine and some breakfast cereals). All formula milks are fortified, but plain cow's milk is not fortified in the UK. Breast milk



generally contains little Vitamin D. Sunshine is the main source of Vitamin D. However, Vitamin D can only be made in our skin by exposure to sunlight when the sun is high in the sky. Therefore, in most of the UK from November to February, and in Scotland from October to March, Vitamin D can not be made from sunshine.

Whether ingested orally or made in the skin under the action of Ultraviolet light, Vitamin D is converted to 25hydroxyVitaminD in the liver and then on to 1,25-dihydroxyVitaminD in the kidney. It is this which has potent metabolic effects.

There are two types of Vitamin D: Ergocalciferol (Vitamin D2) a plant product and Colecalciferol (Vitamin D3) which is a fish or mammal product. The BNF and many other authorities regard them as interchangeable. However, 'Activated Vitamin D' preparations such as Calcitriol or Alfacalcidol **should not be used** for the treatment of simple



Vitamin D deficiency. They should only be used for the treatment of complex cases by specialists. They are ineffective in treating simple Vitamin D deficiency and can cause severe adverse effects, particularly hypercalcaemia. Simple Vitamin D is safe and is the treatment for D deficiency.

What is Vitamin D deficiency?

Vitamin D deficiency historically has been defined as a blood level of 25hydroxyVitaminD below 25nmol/L. There is scientific debate about the optimal Vitamin D blood level. Current practice in the UK, as recommended by the British Paediatric and Adolescent Bone Group, is to continue to use that as the defined level of deficiency, and to define 'insufficiency' as between 25 and 50 nmol/L. Some laboratories and authorities use higher levels but this current practice is based on robust evidence of benefits to bone health when levels are more than 50nmol/L. Vitamin D deficiency can cause seizures and cardiomyopathy in infants, rickets and poor growth in children and muscle weakness at any age.

Who is likely to get Vitamin D deficiency?

People particularly at risk are those with:

1. Increased need:

- pregnant and breastfeeding women
- infants
- twin and multiple pregnancies
- adolescents
- obesity

2. Reduced sun exposure:

- northern latitude, especially above 50 degrees latitude (eg UK)
- season – in winter and spring
- Asian and African people – dark skin needs more sunshine to make Vitamin D
- wearing concealing clothing
- immobility, eg inpatients or those with conditions like cerebral palsy
- excessive use of sun block – most block UVB more than UVA

3. Limited diet (but remember sunshine is most important source of Vitamin D):

- vegetarians and vegans
- prolonged breastfeeding – even if mother has sufficient Vitamin D
- exclusion diets – eg milk allergy
- malabsorption
- liver disease
- renal disease
- some drugs – eg Anticonvulsants, Anti-TB drugs

Although sunshine is the usual source of Vitamin D, diet is of course the source of Calcium. It is particularly important to prevent Vitamin D deficiency in children with limited Calcium intake.

Prevention

The Department of Health and the Chief Medical Officers recommend a dose of 7-8.5 micrograms (approx 300 units) for ALL children from six months to five years of age. This is the dose that the NHS 'Healthy Start' vitamin drops provide. The 'Healthy Start' programme aims to provide vitamins free to people on income support. The British Paediatric and Adolescent Bone Group's recommendation is that exclusively breastfed infants receive Vitamin D supplements from soon after birth.

Adverse effects of Vitamin D overdose are rare but care should be taken with multivitamin preparations as Vitamin A toxicity is a concern. Multivitamin preparations often contain a surprisingly low dose of Vitamin D.

Standard prevention doses

Category	Dose and frequency	Examples of preparations
Newborn up to 1 month	300 - 400 units daily	Abidec, Dalivit, Baby D drops and 'Healthy Start' Vitamins
1 month - 18 years	400 units - 1,000 units daily	Over-the-counter preparations eg: Abidec, Dalivit, Boots high strength Vitamin D, Ddrops, Holland & Barrett SunviteD3, DLux oral spray, SunVitD3 and Vitabiotics tablets

Note: A dose of 10 micrograms of Vitamin D = 400 units

Treatment of deficiency with symptoms

Category	Vitamin D dose and frequency	Duration
Up to 6 months	1,000 units - 3,000 units daily	4 - 8 weeks
6 months - 12 years	6,000 units daily	4 - 8 weeks
12 -18 years	10,000 units daily	4 - 8 weeks

Vitamin D had been difficult to obtain in treatment doses, but is now prescribable as Colecalciferol Liquid 3,000 units/ml. Tablets or capsules of 400, 1,000, 10,000, 20,000 units are also prescribable. Combined 'Calcium and Vitamin D' tablets usually contain only 200 or 400 units of Vitamin D which is a relatively low Vitamin D dose. Unless the patient has insufficient Calcium intake it is often better, and cheaper, to prescribe a pure Vitamin D product.

The same effect may be achieved by multiplying the dose by seven and giving it weekly. In older children, especially if compliance is a concern, some recommend a single dose (multiply daily dose by 30).

It is essential to check the child has a sufficient dietary Calcium intake, and that a maintenance Vitamin D dose follows the treatment dose and is continued long term (see standard prevention doses overleaf).

Follow-up: Some recommend a clinical review a month after treatment starts, asking to see all vitamin and drug bottles. A blood test can be repeated then, if it is not clear that sufficient vitamin has been taken. Current advice for children who have had symptomatic Vitamin D deficiency is that they continue a maintenance prevention dose at least until they stop growing. Dosing regimens vary and clinical evidence is weak in this area. The RCPCH has called for research to be conducted.

Assessing the patient

Characteristics	Management
No risk factors	No investigations, lifestyle advice* and consider prevention
Risk factors, no symptoms	Lifestyle advice* and prevention
Risk factors and symptoms or signs	Blood tests and/or xray, treatment and long-term prevention

*Lifestyle Advice: Vitamin D and the Sun Consensus statement 2010, www.bad.org.uk/site/1221/default.aspx

The consensus statement 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.'

Symptoms and signs in children

Infants	Seizures, tetany and cardiomyopathy
Children	Aches and pains; myopathy causing delayed walking; rickets with bowed legs, knock knees, poor growth and muscle weakness
Adolescents	Aches and pains, muscle weakness, bone changes of rickets or osteomalacia

Blood tests

25hydroxyVitaminD is the standard blood test, and is an excellent marker of body stores. People with risk factors and symptoms of hypocalcaemia or D deficiency should have a check of their blood level. The blood test requires about 2ml of serum and does not need to be transported to the laboratory urgently. The cost of this test is approximately £20. Basic bone biochemistry (Calcium, phosphate and alkaline phosphatase) is often normal despite significant Vitamin D deficiency. High alkaline phosphatase implies rickets. 25hydroxyVitaminD is measured in nmol/L in the UK, but in ng/ml in the USA. $50\text{nmol/L} = 20\text{ng/ml}$.



Parathyroid hormone (PTH)

PTH is produced in the neck glands when the parathyroid Calcium-sensing receptors detect a low level of blood Calcium. PTH levels are a helpful measure of Calcium and Vitamin D status. In children a high

level of PTH is usually due to Vitamin D deficiency or a lack of Calcium in the diet. Other causes (eg parathyroid tumours or renal failure) are rare.

Treatment of relatives

If a patient is diagnosed with Vitamin D deficiency the family should be screened or treated. At least screening by history taking should take place, and prevention advice given. Investigation of other family members by blood testing may be indicated. Alternatively, prescribe a Vitamin D supplement to those sharing the same sun exposure and diet.

After treatment, children who were deficient or insufficient should continue long-term low-dose supplements until completion of growth, unless lifestyle changes (diet/sun exposure) are assured.

Useful links

www.gov.uk/government/publications/vitamin-d-advice-on-supplements-for-at-risk-groups

www.healthystart.nhs.uk

<http://bpabg.co.uk/position-statements/vitamin-d-and-fractures>

www.rcpch.ac.uk/positionstatements

Disclaimer: The RCPCH does not endorse any particular commercial product; those listed are examples of products in the UK. Check your local Trust guidelines for specific recommendations.

Acknowledgements:

Prof Mitch Blair, RCPCH Officer for Health Promotion

Dr Benjamin Jacobs, Royal National Orthopaedic Hospital

Dr Colin Michie, Ealing Hospital NHS Trust
RCPCH Nutrition Committee and specialty groups BAPM and BACCH



Royal College of
Paediatrics and Child Health

Leading the way in Children's Health

**For more information visit www.rcpch.ac.uk/vitamin-d
or contact Dr Benjamin Jacobs at bj@nhs.net**