# Diagnosis and Management of Vitamin D Deficiency in Children

# Vitamin D

Vitamin D is an essential nutrient needed for healthy bones and to control the amount of calcium in the blood. More than 90% of Vitamin D supply is derived from sunlight (ultraviolet B light). However, Vitamin D can only be made in the skin by exposure to sunlight. Therefore, in most of the UK from November to February the sun is not strong enough for Vitamin D to be made from sunshine. Only a few natural foods such as oily fish and eggs (20-40 units per egg) contain significant amounts of Vitamin D. (1) (2)

There are 2 types of Vitamin D: Ergocalciferol (Vitamin D2) and Colecalciferol (Vitamin D3) which are regarded as interchangeable. Activated Vitamin D preparations such as Calcitriol or Alfacalcidol **should not be used** for the treatment of simple Vitamin D deficiency. (1) They are ineffective in treating simple vitavin D deficiency and are more likely to cause adverse effects of hypercalcaemia.

# Vitamin D deficiency

As recommended by the British Paediatric and Adolescent Bone Group, a blood level of 25hydroxyVitaminD below 25nmol/L is defined as Vitamin D deficiency and level between 25-50 nmol/L is defined as Vitamin D insufficiency. (3)

**All those with risk factors (box 1) should have daily supplementation. For doses/preparations see table 2 (vitamin D insufficiency)**

# Whether to do a blood test?

Routine blood tests are not necessary for children on routine supplementation of 400IU daily- including those with risk factors – see Box 1. (Nb nausea and vomiting may indicate hypercalcaemia)

Patients should be assessed as described in table 1. (1)

If clinical concern of severe vitamin D deficiency, then consider measuring vitamin D (1.2 mls of EDTA), bone profile and consider LFT, coeliac screen and U&E see below for interpretation and treatment.

If a child has vitamin D deficiency, it is probable that the siblings and parents are similarly affected, and should commence preventative supplements

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| **Table 1: Assessing the patient** |
| **Characteristics** | **Management** |
| No risk factors | No investigations, lifestyle advice\* and consider routine supplementation |
| Risk factors, no symptoms | No investigations. Lifestyle advice\* and consider routine supplementation |
| Risk factors **and** symptoms or signs | Blood tests and/or X ray, treatment and long-term prevention |

\*Lifestyle Advice: Vitamin D and the Sun Consensus statement 2010- suggests adequate sun exposure to make vitamin D is less time than it takes skin to redden and burn

[http://www.bad.org.uk/for-the-public/skin-cancer/Vitamin-d/Vitamin-d-consensus-2010](http://www.bad.org.uk/for-the-public/skin-cancer/vitamin-d/vitamin-d-consensus-2010)

**Treatment of Vitamin D deficiency/Insufficiency**

**Box 2: Symptoms and signs of Vitamin D deficiency** (4)

**Symptoms and signs of rickets/osteomalacia**

* Progressive bowing deformity of legs
* Waddling gait
* Swelling of wrists and costochondral junctions (rachitic rosary)
* Prolonged bone pain (>3 months duration)

**Symptoms and signs of muscle weakness**

* Delayed walking
* Difficulty climbing stairs
* Cardiomyopathy in an infant

**Abnormal bone profile or x-rays**

* Low plasma calcium or phosphate
* Raised alkaline phosphatase
* Osteopenia or changes of rickets on x-ray
* Pathological fractures

**Box 1: Risk factors of Vitamin D deficiency** (1)

People at risk of Vitamin D deficiency are:

**Increased need:**

* Pregnant and breastfeeding women
* Infants and children 6 months to 5 years\*
* Twin and multiple pregnancies
* Adolescents
* Obesity

**Reduced sun exposure:**

* Northern latitude (e.g. UK)
* Season – in winter and spring
* Asian and African people
* Wearing concealing clothing
* Immobility
* Excessive use of sun block

**Limited diet**

* Vegetarians and vegans
* Prolonged breastfeeding
* Exclusion diets – e.g. milk allergy
* Malabsorption
* Liver disease
* Renal disease
* Some drugs – e.g. anticonvulsants, anti-TB drugs

\*Exclusively breast fed babies supplemented from birth

See Table 2:

Pharmacological treatment doses of Vitamin D as listed in table 2 should be reserved for individuals with symptomatic Vitamin D deficiency who are likely to have Vitamin D levels of less than 25nmol/L. Such doses should achieve a Vitamin D level >50nmol/L and should result in resolution of symptoms. It is advisable to check the child has a sufficient dietary calcium intake. (1) (4)

***Follow up:*** Routine referral to secondary care is not necessary. Consider a clinical review after completion of treatment doses. If symptoms persist or there are concerns about compliance, consider further blood tests. Once an individual has been treated for symptomatic Vitamin D deficiency they should be advised to continue vitamin D supplements n a dose described in table 2 (1) (4).

Adverse effects of Vitamin D overdose are rare.

**Table 2 Vitamin D threshold for action** (1)(5)(6)

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| **Vitamin D level**  | **Action** |
| **>75 nmol/L is optimal** | - |
| **50-75 nmol/L** **Suboptimal** | **Dietary measures, Sufficient sun exposure** |
| **25-50 nmol/L****Vitamin D insufficiency** | **Long term routine supplementation**  |
| Category | Vitamin D Dose and frequency | Preparation (brand) |
| Newborn up to 1 month | 400 units daily | *Fultium-D3 Drops (colecalciferol)* *400 units = 6 drops* |
| 1 month – 18 years | 400 units - 1,000 units daily  | *Fultium-D3 Drops (colecalciferol)**400 units = 6 drops**OR**Fultium D3 capsule if 12 years and above. One capsule = 800 units.**1 capsule daily* |
| **<25 nmol/L****Vitamin D deficiency** | **High doses Vitamin D treatment** |
| Category | Vitamin D dose and frequency | Duration | Preparation |
| Up to 6 months | 3,000 units daily  | 6 weeks | *Fultium-D3 Drops (colecalciferol) 1.1ml daily supply 2 x 25ml bottles* |
| 6 months – 12 years | 6,000 units daily | 6 weeks | *Fultium-D3 drops (colecalciferol)* *2.2ml daily* *Supply 4 x 25ml bottles* |
| 12-18 years | 10,000 units daily | 6 weeks | *Fultium-D3 drops (colecalciferol)**3.6ml daily**Supply 6 x 25ml bottles*  |

10 micrograms of Vitamin D = 400 units

NB Duration of treatment can be 4-8 weeks

Fultium-D3 drops contain 2740 units (68.5 micrograms) per ml of colecalciferol. 3 drops contains 200 units of colecalciferol. Once opened use within 6 months. Can be taken directly or mixed with food. The solution does not contain any nut oils and is suitable for vegetarians.

NB if preparations other than Fultium are used – be aware that abidec/dalivit and over the counter preparations also contain vitamin A and care needs to be taken that the Recommended Daily Amount is not exceeded.

# Bibliography

1. **RCPCH.** http://www.rcpch.ac.uk/guide-vitamin-d-childhood. *www.rcpch.ac.uk.* [Online] October 2013. http://www.rcpch.ac.uk/system/files/protected/page/vitdguidancedraftspreads%20FINAL%20for%20website.pdf.

2. *Diagnosis and management of vitamin D deficiency.* **Simon H S Pearce, Tim D Cheetham.** 2010, BMJ, Vol. 340, pp. 142-147.

3. *Position statement on vitamin D deficiency.* **British Paediatric and Adolescent Bone Group.** 2012, BMJ.

4. *Vitamin D and child health: part 2.* **Nick J Shaw, M Zulf Mughal.** 5, 2013, ADC, Vol. 98, pp. 368-372.

5. **BNFC.** *British National Formulary for Children.* s.l. : NICE, 2015.

6. **Bristol Vitamin D deficiency Guidance.**