

Primary Care Management of Vitamin D deficiency in Children

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Vitamin D sources

- **Sunlight**

Over 90 % of the body's vitamin D is produced by skin photosynthesis following UVB sunlight exposure. This forms Cholecalciferol- vit D3 : an inactive form of vit D.

- **Food**

Small amounts of vitamin D are obtained from food sources such as oily fish, eggs (each egg contains 20-40 IU vit d), mushrooms, fortified breakfast cereals and margarine.

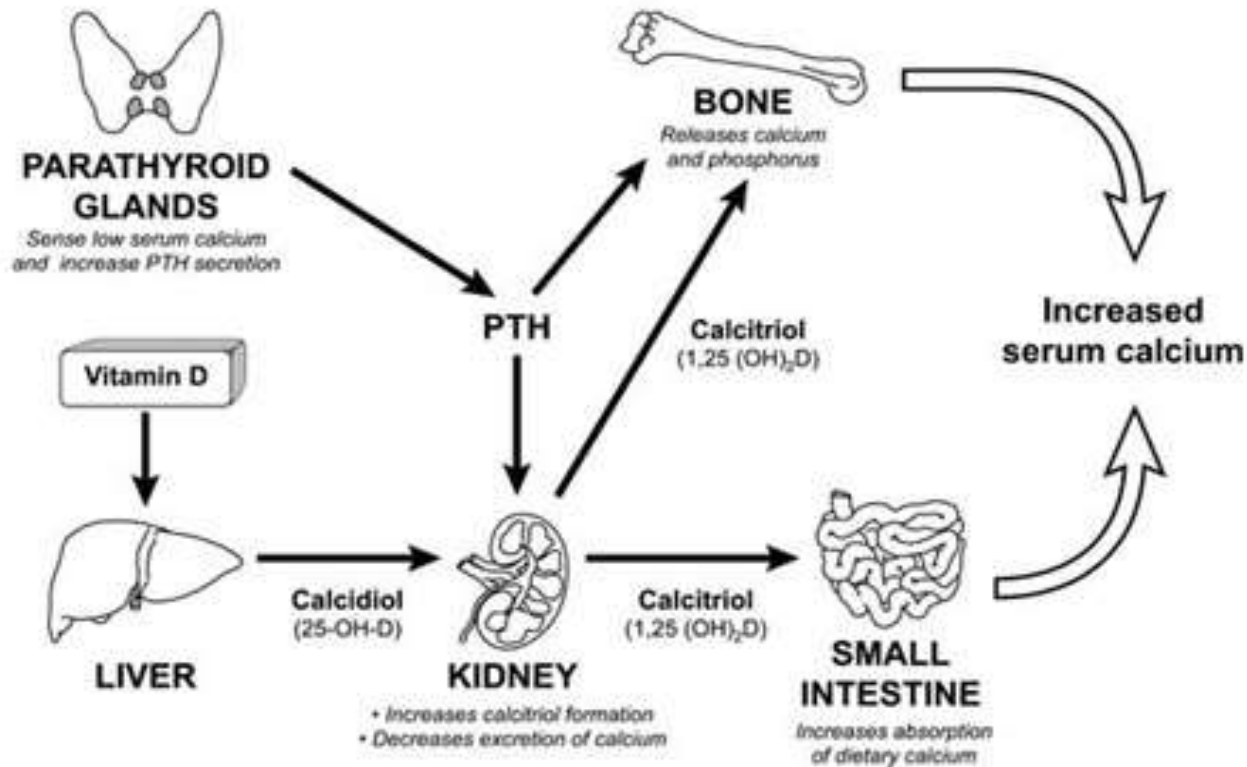
All formula milks are fortified with vitamin D but plain cow's milk is not in the UK. This form is Ergocalciferol – vit D2, which is also inactive.

- Activation of vitamin D occurs in the liver and kidney to form **CALCITRIOL**.

Calcitriol

- acts on intranuclear receptors present on most cells in the body
 - stimulates absorption of calcium from the GI tract and reduces loss of calcium in the urine
 - directly stimulates bone remodelling
- PTH (parathyroid hormone) activates an enzyme which converts inactive vitamin D to the active form – and so can be raised in vitamin D deficiency.

Vitamin D metabolic pathway



What is Vitamin D deficiency?

- Confirmation of vitamin d deficiency is by measurement of serum levels of 25-OH Vit D (25 Hydroxyvitamin D).
- There is debate as to the optimum serum level of vitamin D. Some experts suggest > 75 nmol/l.
- Currently < 25 nmol/L is considered “deficient”, 25-50nmol/L “insufficient” and 50nmol/L and above “sufficient” by the British Paediatric and Adolescent bone group.

Some laboratories use higher levels to define deficiency. Calderdale CCG guidelines suggest < 30 nmol/l is deficient.

Risk factors for Vitamin D deficiency

- **Increased need**

At risk groups include:

Pregnant and breastfeeding women

Twin and multiple pregnancies

Infants

Adolescents

Obesity (vitamin D is fat soluble, obese patients may have increased requirements due to deposition in adipose tissue)

- **Reduced sun exposure**

Northern latitude – especially above 50 degrees latitude (e.g. In the UK there is no radiation of appropriate wavelength between October and March)

Winter and spring season

Asian and African children – darker skin needs more sun exposure to produce vitamin D

Wearing concealing clothing

Immobility e.g inpatients or those with conditions like cerebral palsy or institutionalised individuals

Use of sunscreen – most block UVB rather than UVA and SPF15+ blocks 99 % vitamin D synthesis

Photosensitive skin conditions

- **Reduced oral intake/limited diet**

Vegetarians and vegans

Prolonged breastfeeding – even if mother has sufficient vitamin D

Exclusion diets e.g. Milk allergy

- **Disorders impacting on Vitamin D metabolism**

Malabsorption e.g. Coeliac, Crohns, Cystic fibrosis

Liver disease

Renal disease

Medication eg. Anticonvulsants e.g Carbamazepine, Phenytoin, anti-TB medication

- Although the main source of vitamin D is sunlight, diet is the source of calcium.
- Both are needed for good bone health
- [BDA calcium diet sheet](#)

Prevention of Vitamin D deficiency in Children

The Department of Health recommends:

- **ALL** pregnant and breastfeeding women should take a daily supplement of 400 IU vitamin D (10mcg) to ensure maternal needs are met and to build adequate foetal stores for early infancy
- **ALL** infants and young children from 6 months to 5 years should take a daily supplement containing vitamin D, approx 300IU (7-8.5mcg)
- **Breastfed infants** need to start vitamin D supplements 1 month from birth

- Adolescents with reduced sun exposure should take 400IU vitamin D daily.

Examples of preparations available include Abidec, Dalivit, Baby D drops, “Healthy Start” vitamins.

- Lifestyle advice re “Safe sun” may be appropriate.

Recommend short periods outside around midday in the UK from May to September (3-4 x per week) exposing minimum of face/hands and forearms **WITHOUT** sunscreen. The time should be less than the time to redden or burn – in Caucasian children approx 10 mins but will vary according to skin pigmentation, pollution and age.

Signs and symptoms of Vitamin D deficiency 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, dental deformities, spinal deformities, prominent costochondral joints (“rickety rosary”), fatigue

- **Adolescents**

Aches and pains, muscle weakness, fatigue, bone changes of rickets or osteomalacia

Treatment of Vitamin D deficiency

- There is much variation in recommendations for treatment of deficiency with different guidelines across the country and different products in use!

The BNF for children recommends the following treatment regime:

Child 1-6 months – **3000 IU** daily for 8-12 weeks

Child 6 months -12 years – **6000 IU** daily for 8-12 weeks

Child 12-18 years – **10 000 IU** daily for 8-12 weeks

The Royal College of Paediatrics and Child Health recommend the same doses for 4-8 weeks followed by maintenance dose of 400IU daily.

Protocols for management of Vitamin D deficiency in children

- [Calderdale CCG Vitamin D in children guidelines](#)
- [Northamptonshire Prescribing Advisory Group guidelines](#)
- [Birmingham CCG formulary](#)

These are some examples of varying protocols. There are regimes, where if compliance is a concern, once weekly doses can be given for treatment:

[Nottingham Childrens Hospital Vitamin D guidance](#)

Monitoring serum vitamin D

- Vitamin D has a long half-life so levels can take up to 6 months before reaching a steady state
- Calderdale CCG guidelines recommend repeat testing shortly after completion of treatment dose for deficiency .. **Only if the patient is symptomatic.**
- Northamptonshire guidelines suggest repeat testing serum calcium at 3 and 6 months and vitamin d levels at 6 months regardless of symptoms
- If repeat levels are $>50\text{nmol/l}$ Calderdale CCG guidelines suggest continuing maintenance dose at 200-400IU per day (dose dependent on age) until fully grown if risk factors for deficiency still present

Treatment of relatives

- The Royal College of Paediatrics and Child Health recommend that relatives of anyone diagnosed with vitamin D deficiency should be screened or treated. Screening via history and prevention advice should be given.
- Testing serum vitamin D levels may be appropriate

When to refer to secondary care

- Hypocalcaemia
- Markedly raised alkaline phosphatase (> 2 x upper limit normal for age)
- Deficiency established with absence of known risk factors
- Atypical biochemistry (persistent hypophosphataemia, elevated creatinine)
- Failure to reduce alkaline phosphatase levels within 3 months
- Family history (parent, siblings) with severe rickets

- Infants under one month with calcium $<2.1\text{mmol/l}$ at diagnosis as risk of seizure. Check vitamin D level of mothers in this group immediately and treat, particularly if breast feeding
- If compliance issues are anticipated or encountered during treatment
- Satisfactory levels of vitamin D not achieved after initial treatment
- Underlying complex medical disorder e.g. Liver disease or malabsorption
- Child has abnormalities or deformities probably related to rickets

Summary

- Vitamin D deficiency is common in children as well as adults. Clinicians need to be aware of risk factors and symptoms to ensure they test for it appropriately.
- There is debate regarding optimum levels of serum Vitamin D. Clinicians should use their judgement when treating individuals.
- Most children who are vitamin D deficient will be treated in primary care but it is important to be aware of when to refer to secondary care.
- There is considerable variation in treatment regimes for vitamin D deficiency across the country. The BNF for children treatment guidelines provide a framework to assess these protocols against.

References

- [RCPCH guidelines on vitamin D deficiency in Children October 2013](#)
- [Northamptonshire Prescribing Advisory Group Guidelines for treatment and prophylaxis of vitamin D deficiency in Children and Adolescents](#)
- [Calderdale CCG Children's pathway for vitamin D deficiency in Primary Care March 2015](#)
- [Summary of Birmingham Childrens Hospital Vitamin D guideline 2013](#)
- [BNF for children vitamin D](#)