Vitamin D Deficiency in Children

Vitamin D deficiency is common and its management can be an area of confusion owing to lack of high quality evidence for children. The Royal College of Paediatrics and Child Health issued interim practical “consensus” guidance in October 2013 regarding suggested definition, prevention, investigation and management of Vitamin D deficiency. This guideline is based on their recommendations alongside local recommendations regarding specific management options. It has been updated in 2016 to reflect the current recommended Vitamin D preparations for each dosing strategy. See also the Guide for Vitamin D in Childhood, October 2013, RCPCH (http://www.rcpch.ac.uk/guide-vitamin-d-childhood) for further information.

Note there is separate guidance regarding vitamin D targets and supplementation for certain patient groups, eg cystic fibrosis, chronic renal disease. Please consult the relevant specialist guidelines for these patients.

Some key points:

1. Remember lifestyle advice for all children and young people:

<table>
<thead>
<tr>
<th>Safe Sun (provides 85-90% of our vitamin D)</th>
<th>Recommended short periods outside around midday in the UK between May-September, exposing minimum of face/hands/forearms WITHOUT sunscreen. The time should be less than the time taken to redden or burn (in Caucasian children approx. 10 minutes but the exact time will depend on skin pigmentation, pollution, age). If children have sun-sensitive conditions or are using medication which may predispose this, exposure should be restricted as per dermatologist advice.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet (only 10-15%)</td>
<td>Foods rich in vitamin D: oily fish (salmon, mackerel, sardines), eggs (20-40 units per egg), formula milk, fortified foods (margarine, cereals), red meat/liver, mushrooms. Dairy products are not routinely fortified so are not sources of vitamin D but are good sources of calcium.</td>
</tr>
</tbody>
</table>

2. **Prevention** dose supplements where indicated – see chart, page 2

3. Routine vitamin D level testing of asymptomatic patients is not recommended, but address lifestyle factors and assess the need for prevention dose supplements. Investigate if symptomatic (see chart, page 2) or if in chronic illness high risk group requiring regular monitoring.

4. **Treatment** doses recommended are for patients with symptoms (see chart, page 2) and confirmed vitamin D deficiency (< 25nmol/L). The same treatment doses may be used safely for patients with vitamin D insufficiency (25-50nmol/L) who are symptomatic. Patients under the care of orthopaedics who are tested for vitamin D levels are generally symptomatic and require treatment doses of vitamin D whether deficient or insufficient.

5. Testing is not recommended if asymptomatic, but if found to be insufficient (25-50nmol/L) and asymptomatic, advise prevention dose supplements (see “Prevention doses”). There is no need to retest.

6. Vitamin D deficiency can usually be managed in primary care. The following cases should be referred to secondary care:
   - Symptomatic Vitamin D deficiency i.e. clinical evidence of rickets. Same day referral if symptomatic of hypocalcaemia or bone disease.
   - Treatment failure due to absorption or compliance issues (this could be via a phone call discussion or advice and guidance request)
Prevention

Lifestyle advice for all:
- Safe sun
- Dietary advice

Prevention dose supplements advised for:
- All children aged 6 months to 5 years if taking less than 500ml formula and breastfed infants from 1 month if mother did not take antenatal supplements (Dept of Health guidance)
- Infants from birth if exclusively breastfed (British Paediatric and Adolescent Bone Group recommendation)
- Children who have had treatment for vitamin D deficiency and symptoms – these children need long-term prevention supplements
- Children in at risk group – see box

At risk groups:
- Increased need: infants, adolescents, obesity
- Reduced sun: UK winter, dark skin, clothing, immobility, excessive sun block, sun sensitivity.
- Limited diet: vegetarian, prolonged breastfeeding, malabsorption, drugs eg anticonvulsants, anti-TB drugs

Prevention doses:
See Page 5

Investigation

Investigate if there are symptoms/signs of vitamin D deficiency:
- Serum 25-hydroxy-vitamin D level (2ml in yellow top bottles)
- Bone profile (Ca, PO4, Alk Phos)
- PTH – if hypocalcemic / rickets
- X-ray wrist/knee if concerns re rickets

Children with chronic illness including renal/liver disease, malabsorption will require monitoring of vitamin D levels as per their own specialist guidance

Symptoms / signs
- Hypocalcaemic seizures, tetany
- Cardiomyopathy
- Aches and pains
- Rickets: swollen ankles/wrists, rachitic rosary, bow legs, knock knees
- Muscle weakness, delayed walking
- Incidental investigation finding (osteopenia, low calcium, high Alk Phos)

Screen +/- treat other family members

Treatment

If vitamin D deficient, give treatment dose for 7 weeks; see Treatment Section below (page 5) for dosing.

Recheck vitamin D and bone profile to ensure normal at end of treatment course:
- If not normal: check compliance, consider malabsorption or genetic rickets – discuss with Paediatric Endocrinology
- If normal, continue long term prevention dose

Screen +/- treat other family members
Treatment Options

There are two types of simple Vitamin D preparations: ergocalciferol (D2) which is plant-derived, and colecalciferol (D3) which is an animal product. In the BNFc they are equivalent in dosing. Costs and availability of Vitamin D preparations change regularly. This guideline will therefore be reviewed annually and updated to reflect the most cost effective preparations at that time, as necessary.

Oral is the preferred route of treatment. See chart below for prevention and treatment doses. A dose of 10 micrograms of Vitamin D = 400 units.

_**Remember: treatment doses should be followed by a maintenance prevention daily dose of vitamin D long-term (certainly until growth completed).**_

**Prevention Doses**

Newborn up to 1 month: 300-400 units daily

1 month to 18 years: 400-800 units daily (300 units daily if using Healthy Start Vitamin Drops)

Administration options include:

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Dose</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy Start Vitamins (Multivitamin Drops)</td>
<td>5 drops (300 units) daily</td>
<td>Free for eligible** children less than 4 years of age. Supply via Health Visitor.</td>
</tr>
<tr>
<td>Abidec® (Multivitamin Drops)</td>
<td>0.3ml - 0.6ml (200 units to 400 units daily)</td>
<td>GSL; Children under 1 year, 0.3ml daily; 1-12 years, 0.6ml daily. Do not use in peanut or soya allergy.</td>
</tr>
<tr>
<td>Fultium D3® drops</td>
<td>6 drops (400 units) daily</td>
<td>POM – licensed for children under 2 years old</td>
</tr>
<tr>
<td>Fultium D3® capsules</td>
<td>800 units daily</td>
<td>POM. Not recommended for children under 12 years old</td>
</tr>
<tr>
<td>Dalivit®</td>
<td>0.3ml to 0.6ml (200 units to 400 units daily)</td>
<td>GSL; up to 1 year, 0.3ml (7 drops) daily; over 1 year, 0.6ml (14 drops) daily.</td>
</tr>
</tbody>
</table>

**Patients should be encouraged to buy supplements unless in extreme circumstances where a prescription may be required**

Patients can buy single vitamin D supplements at most pharmacies and supermarkets for less than £3 for a three month supply. Women and children who qualify for the Healthy Start scheme can get free supplements containing the recommended amounts of vitamin D. [NHS choices website](https://www.nhs.uk/services/medicines/vitamin-d/) can provide additional information for patients.

Products available over the counter are suitable for replacement/maintenance doses as well as for prophylaxis in winter if required.

**Women who are at least 10 weeks pregnant and families with children under four years old qualify for Healthy Start if the family is getting: Income Support, or Income-based Jobseeker’s Allowance, or Income-related Employment and Support Allowance, or Child Tax Credit (but not Working Tax Credit unless the family is receiving Working Tax Credit run-on only*) and has an annual income of £16,190 or less (2014/15). See [https://www.healthystart.nhs.uk/for-health-professionals/](https://www.healthystart.nhs.uk/for-health-professionals/) for more information**

There are other over the counter options – advice families to check vitamin D strength as this may be relatively low in multivitamin or combined preparations.
**Treatment Doses**

Prescribe as weekly dosing where possible, as this is the most cost effective preparation:

**Invita D3® Oral Solution, 25,000 units/1ml “snap ampoules”**

<table>
<thead>
<tr>
<th>Age</th>
<th>Dose</th>
<th>Course length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 6 months</td>
<td>25,000 units (1 ampoule) as a single dose, once a week</td>
<td>7 weeks</td>
</tr>
<tr>
<td>6 months – 12 years</td>
<td>50,000 units (2 ampoules) as a single dose, once a week</td>
<td>7 weeks</td>
</tr>
<tr>
<td>Over 12 years</td>
<td>75,000 units (3 ampoules) as a single dose, once a week</td>
<td>7 weeks</td>
</tr>
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</table>

*These doses are an extrapolation of the dose for ergocalciferol (which is equivalent to colecalciferol), as per the BNF, RCPCH & NOS. The daily dose has been scaled up to a measurable weekly dose.*

If daily dosing is felt to be more appropriate, use Fultium D3® drops: 2740 units/ml. The dropper cap on the bottle can be easily removed which allows dose measurement by syringe.

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<tbody>
<tr>
<td>Below 6 months</td>
<td>2740 units (1mL) once a day</td>
<td>7 weeks</td>
</tr>
<tr>
<td>6 months – 12 years</td>
<td>5480 units (2mL) once a day</td>
<td>7 weeks</td>
</tr>
<tr>
<td>Over 12 years</td>
<td>8220 units (3mL) once a day</td>
<td>7 weeks</td>
</tr>
</tbody>
</table>

**Please be aware some preparations contain nut oils.** Fultium D3® drops and Invita D3® snap ampoules contain coconut oil and palm kernel oil, and olive oil respectively. They are suitable for patients with peanut allergies. They are also suitable for vegetarians, and are Kosher and Halal.

**Tablets or capsule preparations are also available:**

- 800 unit (Fultium D3®) or 1000 units (Stexerol D₃®)
- 20,000 units (Aviticol®, Fultium D3®, Plenachol®)

**Note:**

- Activated preparations of Vitamin D such as alfacalcidol or calcitriol are NOT indicated for the treatment of simple vitamin D deficiency.
- Combination preparations of vitamin D/calcium are not required to treat vitamin D deficiency – however it is important to assess that dietary intake of calcium is sufficient and
to supplement where insufficient or where there is documented hypocalcaemia (see hypocalcaemia guideline).

Secondary Care Only Alternative Options

a) High Dose Oral Treatment: In secondary care, higher single oral doses can be given instead of daily or weekly dosing:

  e.g. daily dose x 30 given as one single dose (mainly used in older children, where compliance may be an issue).

b) Vitamin D Stoss Therapy (secondary care only)

  A High Dose vitamin D therapy given intramuscularly in a single dose (secondary care only).

   **Advantages:**
   - Compliance is not an issue
   - Faster improvement in biochemical marker (4-7 days), compared with daily dose (2-3 weeks)
   - Overcome malabsorption problems

   **Disadvantages:**
   - IM injection (needle phobia issues)
   - Some concerns regarding risk of intoxication (In the context of confirmed vitamin D deficiency there is no evidence of increased risk of vitamin D intoxication with the single high doses suggested below)

Doses over the age of one month:

- 1 month up to 6 months: Ergocalciferol 150 000 units
- 6 months up to 12 years: Ergocalciferol 300 000 units
- 12 years and over: Ergocalciferol 500 000 units

**Maintenance Stoss therapy:**

In older children and adolescent patients with poor compliance, a maintenance treatment can be given over winter period to prevent the relapse of vitamin D deficiency

Doses: Two (IM) doses of 100 000 units. First dose at the beginning of autumn (Oct) and second dose 3 months later (Jan).

**Monitoring of response**

If hypocalcaemia at presentation follow hypocalcaemia guideline. If calcium is normal at presentation, no need to recheck during Vitamin D treatment. Blood test should be repeated at the end of treatment to ensure normalisation of Vitamin D level and other biochemical abnormalities (PTH is a good marker for normal Ca haemostasis).

If definite rickets changes on initial X-rays consider a repeat X-rays to document improvement in radiological features after few months (the skeletal deformities may take years to normalise).

**If Vitamin D deficiency or rickets do not resolve at end of treatment:**

- Check compliance: consider Stoss therapy.
- Investigate for malabsorption disorder (e.g. Coeliac disease)
- Consider genetic rickets (X-linked Hypophosphataemic rickets):
Discuss with Paediatric Endocrinology Team

Once on maintenance treatment do twice a year blood screen in early autumn (Sept/October) and early spring (March/April).

For further advice on the management of Vitamin D deficiency cases please discuss with Paediatric Endocrinology Team

Contact numbers
Dr Denvir/Dr Randell’s secretary - 62336
Endocrinology Registrar - Bleep 784-1411

For in or out of hours advice, contact the on call Paediatric Endocrinology Consultant via QMC switch board 24 hours/day 0115 924 9924

References
Guide for Vitamin D in Childhood, Royal College of Paediatrics and Child Health, October 2013
Elder C, Bishop N. Rickets. Lancet 2014; 383; 9929; p1665-1676
Vitamin D – Advice on Supplements in At Risk Groups, letter from the Chief Medical Officers https://www.gov.uk/government/publications/vitamin-d-advice-on-supplements-for-at-risk-groups (accessed January 2015)
SPC for Invita D3, accessed 11/5/17, available at medicines.org.uk
SPC for Fultium D3 drops, accessed 11/5/17, available at medicines.org.uk
Vitamin D and Bone Health: A practical clinical guideline for management in children and young people, National Osteoporosis Society, June 2015, available here

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