

SIGNS AND SYMPTOMS OF RICKETS:	
Progressive bowing of legs (can be a normal finding in toddlers) Progressive knock knees Wrist swelling	Rachitic rosary Craniotabes Delayed tooth eruption and enamel Poor growth and muscle weakness

Consider referral to/discuss with paediatrician
INVESTIGATIONS
Radiological assessment
Vitamin D (25(OH)D) (consider PTH if hypocalcaemic)
Bone profile (calcium, phosphate and ALP)
U+Es, creatinine and LFTs
FBC (and ferritin to identify associated deficiencies)

• Routine screening for vitamin D deficiency is not recommended, however if taking bloods for a clinical indication, then may consider including vitamin D
• The family and siblings of children with rickets are also likely to be deficient in vitamin D. It is good practice to review family members

OTHER SYMPTOMS OR CONDITIONS ASSOCIATED WITH VITAMIN D DEFICIENCY:	
Infants	Seizures, tetany and cardiomyopathy (if suspected refer to A+E urgently)
Children	Long standing unexplained bone pain (> 3 months) or aches and pain Muscle weakness (e.g. difficulty climbing stairs or rising from a chair, waddling gait or delayed walking)
Adolescents	Aches and pains, muscle weakness, bone changes of rickets or osteomalacia

Vitamin D Testing Indicated
First exclude other causes of symptoms e.g. cancer, and discuss with/refer to a paediatrician where appropriate
INVESTIGATIONS
Vitamin D (25(OH)D) (consider PTH if hypocalcaemic)
Bone profile (calcium, phosphate and ALP)
U+Es, creatinine and LFTs
FBC (and ferritin to identify associated deficiencies)

IMMEDIATE REFERRAL TO A&E IF ANY OF THE BELOW: Symptomatic hypocalcaemia e.g. irritability, tetany, brisk reflexes, seizures or other neurological abnormalities. If asymptomatic, discuss with a paediatrician.

ABNORMAL INVESTIGATIONS:
Hypocalcaemia or hypophosphataemia <i>NB ALP usually raised in children due to the growing skeleton</i> https://tinyurl.com/mr3krbn9 Radiographs showing osteopenia, rickets or pathological fractures on radiographs

Vitamin D investigation recommended
Consider discussing with or refer to a paediatrician

CHRONIC DISEASE THAT MAY INCREASE RISK OF VITAMIN D DEFICIENCY:
Chronic renal disease Chronic liver disease Malabsorption syndromes (e.g. coeliac disease, Crohn's disease, cystic fibrosis)

Vitamin D investigation recommended
Consider discussing with or refer to a paediatrician

TREATMENT WITH BONE-TARGETED MEDICINES THAT REQUIRE VITAMIN D SUFFICIENCY SUCH AS BIPHOSPHONATES

Vitamin D investigation recommended
Consider discussing with or refer to a paediatrician

GROUPS AT HIGH RISK OF VITAMIN D DEFICIENCY (1 or more)
Diets insufficient in calcium (e.g. vegan/low dairy) or restrict major food sources of vitamin D or generally poor diet Limited sun exposure e.g. cover up skin, photosensitive patients or those advised to apply high factor sun block due to malignancy risk e.g. cancer survivors Spend little time outdoors e.g. those with limited mobility Darker skin e.g. African, African-Caribbean or South Asian origin Taking anticonvulsants that induce liver enzymes e.g. carbamazepine, phenobarbitone, phenytoin or primidone Family members with proven vitamin D deficiency Childhood or adolescent obesity (body mass index greater than the 98th BMI for age centile)

Vitamin D testing is NOT recommended
Primary Prevention Advice: maintain adequate vitamin D levels through dietary intake and multivitamin supplements
Public Health England Recommendation on Vitamin D Supplements (2016):
Babies from birth - 1 year daily supplement of 340 - 400 units vitamin D (none if receiving > 500 mL infant formula per day)
Children aged 1-4 years daily supplement of vitamin D 400 units
Children aged > 4 years:
a) Consider taking a daily supplement containing vitamin D 400 units in autumn and winter
b) People whose skin has little or no exposure to the sun, or who always cover their skin outside need to take a daily supplement containing vitamin D 400 units throughout the year
c) People with dark skin should consider taking a daily supplement containing vitamin D 400 units throughout the year
Infants/children residents of City and Hackney:
4 weeks - 4 years: entitled to Healthy Start vitamins free of charge. See <https://hackney.gov.uk/healthy-start> for more information
Inadequate dietary calcium intake: advise on dietary measures to correct this: <https://www.bda.uk.com/resource/calcium.html>

Patient presents with following signs and symptoms (please also see page 1 of guidance)

Infants	Seizures, tetany and cardiomyopathy (if suspected refer to A+E urgently)
Children	Long standing unexplained bone pain (> 3 months) or aches and pain Muscle weakness (e.g. difficulty climbing stairs or rising from a chair, waddling gait or delayed walking) Signs and symptoms of rickets e.g. bowed legs, knock knees, wrist swelling, poor growth, muscle weakness
Adolescents	Aches and pains, muscle weakness, bone changes of rickets or osteomalacia

Test Plasma (25(OH)D Levels
(& other appropriate investigations)

Vitamin D Toxicity (> 150 nmol/L)
Refer to, or discuss with a paediatrician

Vitamin D Deficiency (< 25 nmol/L)		Vitamin D Insufficiency (25-50 nmol/L)	Vitamin D Adequate (> 50 nmol/L)						
<p>A) VITAMIN D DEFICIENCY WITHOUT RICKETS OR HYPOCALCAEMIA</p> <p>Colecalciferol (Vitamin D3) Oral Loading Regimen (ensure dietary calcium intake is adequate)</p> <table border="1"> <tr> <td>1 - 5 months</td> <td>3000 units DAILY for 8 weeks*</td> </tr> <tr> <td>6 months - 11 years</td> <td>6000 units DAILY for 8 weeks*</td> </tr> <tr> <td>12 - 17 years</td> <td>10 000 units DAILY for 8 weeks*</td> </tr> </table> <p>Discuss with or refer to a paediatrician if patient has granulomatous disease e.g. TB, sarcoidosis *Using clinical judgement, may prescribe for up to 12 weeks, where appropriate.</p>		1 - 5 months	3000 units DAILY for 8 weeks*	6 months - 11 years	6000 units DAILY for 8 weeks*	12 - 17 years	10 000 units DAILY for 8 weeks*	<p>Maintenance Therapy in 1 month to 18 years old</p> <p>Oral preparations containing Colecalciferol 400 - 600 units daily</p> <p>To continue until significant lifestyle changes made to improve vitamin D status, then follow Public Health England (2016) recommendation. Ensure dietary calcium intake is adequate Give advice on dietary sources of vitamin D Foods rich in vitamin D include:</p> <ul style="list-style-type: none"> Oily fish e.g. salmon, sardines, herring, fresh tuna and mackerel Egg yolks, red meat and liver Fortified foods e.g. some breakfast cereals and yoghurts, margarine and infant formula 	<p>If symptomatic, consider alternative diagnosis as unlikely to be related to vitamin D deficiency.</p> <p>Provide reassurance and advice on maintaining adequate vitamin D status through safe sun exposure and diet.</p> <p>Public Health England Advice (2016):</p> <ul style="list-style-type: none"> Babies from birth - 1 year daily supplement of 340 - 400 units vitamin D (none if receiving > 500 mL infant formula per day) Children aged 1-4 years daily supplement of vitamin D 400 units Children aged > 4 years: <ol style="list-style-type: none"> Consider taking a daily supplement containing 400 units vitamin D in autumn and winter Little/no exposure to sun or always cover skin outside need to take daily supplement containing 400 units vitamin D throughout the year People with dark skin should consider taking a daily supplement containing 400 units vitamin D throughout the year <p>Infants/children residents of City and Hackney: 4 weeks - 4 years: entitled to Healthy Start vitamins free of charge. See https://hackney.gov.uk/healthy-start for more information</p>
1 - 5 months	3000 units DAILY for 8 weeks*								
6 months - 11 years	6000 units DAILY for 8 weeks*								
12 - 17 years	10 000 units DAILY for 8 weeks*								
<p>B) VITAMIN D DEFICIENCY WITH HYPOCALCAEMIA</p> <p>Symptomatic: urgent referral to A+E Asymptomatic: discuss with paediatrician</p>									
<p>C) VITAMIN D DEFICIENCY WITH RICKETS</p> <p>Discuss with 'hot line' paediatrician. See above for colecalciferol dose. Discuss treatment duration with paediatrician.</p>		<p>Monitoring and Assessment</p> <p>Retesting is not normally required if patient is asymptomatic and compliant with vitamin D supplements</p>							

Monitoring and Assessment

At the end of the course of treatment, test vitamin D (25(OH)D), calcium, phosphate and ALP (and PTH if rickets or hypocalcaemia):

- If 25(OH)D > 50 nmol/L and bone profile normal:** See vitamin D insufficiency for maintenance therapy
- If 25(OH)D > 50 nmol/L and bone profile abnormal:** Discuss with or refer to a paediatrician
- If 25(OH)D > 50 nmol/L and symptoms not improved:** Discuss with or refer to a paediatrician as unlikely to be related to vitamin D deficiency
- If 25(OH)D < 50 nmol/L:** Consider discussing with or refer to a paediatrician. Consider poor compliance, drug interactions or underlying disease e.g. renal disease, liver disease and malabsorption

All products below are nutritional supplements and hence unlicensed

Colecalciferol Preparation	Daily Loading Dose (see under vitamin D deficiency for duration of treatment)	Cost
Aciferol® Liquid 2000 units/mL	1-5 months 3 000 units daily for 8-12 weeks 6 months – 11 years 6 000 units daily for 8-12 weeks	£18.00 - £30.60 (8 weeks) £36.00 - £46.80 (12 weeks)
Health Aid capsules 10 000 units	12-17 years 10 000 units daily for 8-12 weeks	£11.46 (8 weeks) £17.19 (12 weeks)

Table 1 Colecalciferol (vitamin D3) Product Choice for Children and Young People

- Colecalciferol (Vitamin D3) must be prescribed by BRAND NAME (see table 1)
- Check to ensure child is **not** supplemented with extra vitamin D during treatment e.g. multivitamin
- Treatment dose to be prescribed by GP and regimen explained to patient/parent/carer
- Encourage patients to purchase maintenance therapy and provide with CCG vitamin D leaflet
- May prescribe maintenance therapy if it is strongly believed patient is unlikely to purchase, or where clinically appropriate

Patient Group	Name and Dose (Prescribe Brand Name)	Constituents	Cost	Important Dietary and Allergen Information (Correct as of Feb 2022)
<p>Eligible Children for Prevention Only (not for maintenance therapy)</p>	<p>Healthy Start® Vitamins 5 drops daily</p>	<p>233 micrograms of vitamin A 20 milligrams of vitamin C 10 micrograms (400 units) of vitamin D3</p>	<p>Babies and children from 4 weeks until their fourth birthday in City and Hackney are eligible for free vitamins</p>	<p>Approved by Vegetarian Society and Halal Monitoring Committee. City and Hackney state it is Kosher certified (Basel K kosher Commission). Also, approved by Kosher London Beth Din (KLBD) Allergens TBC by HS as website has conflicting information</p>
<p>Vitamin D Deficiency (< 25 nmol/L) Oral Loading Dose Regime Do not place loading dose regimen medicines on 'repeat medication list'</p>	<p>Aciferol® D3 liquid 3 000 units daily for 8-12 weeks 6 000 units daily for 8-12 weeks (Nutritional supplement)</p>	<p>Vitamin D3 2000 units/mL (2 x 50 mL) 8 week expiry once opened</p>	<p>1-5 months: 3 000 units daily for 8-12 weeks £18.00 - £23.40 (100 mL - 130 mL) 6 months – 11 years: 6 000 units daily for 8-12 weeks £30.60 - £46.80 (170 mL - 260 mL)</p>	<p>According to manufacturer, suitable for halal, kosher and vegetarian diet. Suitable for people with peanut, nut, soya, lactose, dairy and gluten allergy. Does not contain alcohol.</p>
	<p>Health Aid® Vitamin D3 capsule 10 000 units daily for 8-12 weeks (Nutritional supplement)</p>	<p>Vitamin D3 10 000 units</p>	<p>10 000 units daily for 8-12 weeks £11.46 - £17.19 (56 - 84 tablets)</p>	<p>According to manufacturer, suitable for vegetarian, kosher and halal diets. Suitable for people with peanut, nut, soya, lactose, dairy and gluten allergy.</p>
<p>Maintenance Therapy Advise patients/carers to purchase vitamin D for insufficiency or maintenance after treatment of vitamin D deficiency. GPs can prescribe if they strongly believe a patient/carer is unlikely to purchase vitamin D, or where clinically appropriate. Only prescribe licensed preparations for maintenance for patients in at risk groups. Only consider prescribing nutritional Vitamin D supplements at the GP's discretion when prescribing outside of at risk groups.</p>	<p>Thorens® oral drops 400 - 600 units daily to continue until significant changes made to improve vitamin D status (Licensed POM)</p>	<p>Vitamin D3 10 000 units/mL (10 mL) 6 month expiry once opened</p>	<p>400 units daily = 2 drops £5.85 (lasts 6 months) 600 units daily = 3 drops £5.85 (lasts for about 5.5 months)</p>	<p>Suitable for vegetarian, Kosher and Halal diets. Approved by KLBD Does not contain nut- or soya-derived ingredients. Deemed to be suitable for patients with nut or soya allergies. Is gluten-free and considered suitable for patients with coeliac disease or wheat allergy.</p>
	<p>Aciferol D3® tablet 400 units daily to continue until significant changes made to improve vitamin D status (Nutritional supplement - can be purchased)</p>	<p>Vitamin D3 400 units</p>	<p>400 units daily £3.11 for 28 days</p>	<p>According to manufacturer, suitable for halal, kosher and vegetarian diet. Suitable for people with peanut, nut, soya, lactose, dairy and gluten allergy. Does not contain alcohol.</p>
	<p>DaliVit® oral multivitamin drops (Licensed medicine which can be purchased)</p>	<p>25 mL or 2 x 25 mL Each 0.6 ml contains: Vitamin A Palmitate BP 5,000 units, Ergocalciferol (Vitamin D2) Ph Eur 400 units, Thiamine hydrochloride BP 1 mg, Riboflavin BP 400 micrograms, Pyridoxine hydrochloride BP 500 micrograms, Ascorbic acid BP 50 mg, Nicotinamide BP 5 mg Use manufacturer's expiry</p>	<p>6 weeks - 1 year: 0.3 mL daily > 1 year: 0.6 mL daily £6.50 25 mL (lasts approx. 6-12 weeks) £11.36 2 x 25 mL (lasts approx. 3-6 months)</p>	<p>Suitable for vegetarians and vegans. Approved by KLBD Does not contain nuts/nut oils, soya, gluten, dairy products, animal products/by-products, alcohol, eggs or fish.</p>
	<p>Abidec® oral multivitamin drops (Licensed medicine which can be purchased)</p>	<p>25 mL Each 0.6 ml dose contains: Retinol 1333 IU, Ergocalciferol (Vitamin D2) 400 units, Thiamine Hydrochloride 0.4 mg, Riboflavin 0.8 mg, Pyridoxine Hydrochloride 0.8 mg, Nicotinamide 8 mg and Ascorbic Acid 40 mg 4 week expiry once opened</p>	<p>< 1 year: 0.3 mL daily > 1 - 12 year: 0.6 mL daily £3.87 for 25 mL (lasts 4 weeks)</p>	<p>DO NOT USE IF ALLERGIC TO PEANUTS, NUTS or SOYA. Contains Arachis Oil (Peanut Oil) Suitable for vegetarian, vegan, Kosher and Halal diets Approved by KLBD Does not contain alcohol, lactose or gluten containing ingredients</p>

Please note, product choice may change as and when more cost effective branded products arrive on the market. The medicines management team will update accordingly.
Allergen and dietary status are correct at the time of publishing these guidelines, and while every effort is made to update the guidelines, the status may have changed since then. Therefore, for dietary and/or allergy suitability contact MMT for the most up to date advice at nelondonicb.cahmedicines@nhs.net