Vitamin D Deficiency is a common and under-recognised problem in Ireland. Studies in the UK have estimated the prevalence of deficiency as 14.5% in adults and the prevalence of insufficiency as high as 55%.1 Smaller studies in Ireland have shown similar results.2,3 Vitamin D deficiency causes osteomalacia in adults and rickets in children. Some studies have shown an association between low levels of vitamin D and certain cancers, diabetes, autoimmune diseases and cardiovascular disease.

Versions of vitamin D

There are two different forms of vitamin D. Vitamin D2 which is synthesised by plants (ergocalciferol) and vitamin D3 synthesised by mammals (cholecalciferol). Our main source of vitamin D (about 80%) is vitamin D3, which is made when UVB sunlight acts on 7-dehydrocholesterol in the skin. Vitamin D3 is then transported to the liver where it is hydroxylated to 25-hydroxyvitamin D (25-OH-D). It is this form which is most commonly measured in the lab. 25-OH-D undergoes further hydroxylation in the kidneys and other tissues to become 1,25-OH2-D or calcitriol (the active form).

Increased levels of parathyroid hormone and decreased levels of phosphate act to increase the levels of calcitriol. Fibroblast growth factor 23, which is secreted from osteocytes in the bone matrix, inhibits calcitriol synthesis. Calcitriol stimulates the activity of 24-hydroxylase, an enzyme that converts vitamin D to the inactive form. Vitamin D has many important actions including regulating calcium and phosphate metabolism and also has a role in the immune system and cell growth and differentiation.

There is little naturally occurring vitamin D in most food and high amounts are found only in oily fish and fish oils (such as cod liver oil).4 Smaller amounts are found in egg yolk and liver (see Table 1). Certain foods are fortified with vitamin D including some cereal, margarine, infant formula and milk. The Irish guidelines on recommended daily intake of vitamin D are due to be updated.5 In the most recent guidelines from the US, the recommended dietary allowances are 600IU (15µg) per day in people one to 70 years of age and 800IU (20µg) per day for people over 70.6

Risk factors

Risk factors for vitamin D deficiency include spending little time outdoors or covering most of the skin with clothing or anti-UVB sunscreen, living in latitudes above or below 35 degrees (Ireland is 51 to 55 degrees north), older age, people living in institutions or residential care, obesity, multiparity and people with pigmented skin, eg. from Asia, Africa or the Middle East (see Table 2). In those with fair skin, spending 15 minutes outside in sunlight from April to September two to three times a week is sufficient for adequate vitamin D synthesis, but people with darker skin may need longer exposure.7 Vitamin D levels decline by 20% from late summer to mid winter.16 Secondary vitamin D deficiency can occur where there is impaired fat absorption, eg. pancreatic insufficiency, Coeliac disease, Crohn’s disease, gastrectomy or gastrointestinal bypass surgery. Drugs which are hepatic cytochrome P450 enzyme inducers, such as carbamazepine and phenytoin, increase vitamin D metabolism and can cause deficiency. Long-term use of glucocorticoids is also a risk factor. Liver and renal failure result in reduced hydroxylation of vitamin D to the active form. Vitamin D deficiency in children (before the closure of the epiphyseal growth plates) causes rickets with skeletal deformities such as lateral bowing of the tibia or femur, prominent costochondral joints, frontal bossing or delayed closure of the fontanelles.8 Deficiency can also cause fractures, delayed dentition, poor growth, recurrent infections and bone pain.

Hypocalcaemic seizures can occur in neonates born to mothers deficient in vitamin D (usually in at-risk ethnic minorities) and deficiency can occur in exclusively breastfed babies not receiving vitamin supplementation. Rickets has recently re-emerged as a problem in infants in Ireland and the Food Safety Authority of Ireland (FSAI) currently recommends that all babies in Ireland aged 0-12 months should be given a vitamin D only supplement of 5µg (200IU) daily.

Dietary sources of vitamin D

<table>
<thead>
<tr>
<th>Dietary source</th>
<th>Quantity</th>
<th>Vitamin D (µg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg</td>
<td>1 egg</td>
<td>0.9</td>
</tr>
<tr>
<td>Liver* (lamb)</td>
<td>100g</td>
<td>0.9</td>
</tr>
<tr>
<td>Kidney* (lamb)</td>
<td>100g</td>
<td>0.6</td>
</tr>
<tr>
<td>Salmon</td>
<td>200g</td>
<td>16</td>
</tr>
<tr>
<td>Mackerel</td>
<td>200g</td>
<td>18</td>
</tr>
<tr>
<td>Sardines (canned in oil)</td>
<td>100g</td>
<td>5</td>
</tr>
<tr>
<td>Supermilk (glass)</td>
<td>200ml</td>
<td>2</td>
</tr>
<tr>
<td>Kellogg’s Cornflakes</td>
<td>35g</td>
<td>0</td>
</tr>
<tr>
<td>Kellogg’s Special K</td>
<td>35g</td>
<td>2.5</td>
</tr>
<tr>
<td>Infant formula</td>
<td>500ml</td>
<td>5.5-7.5</td>
</tr>
</tbody>
</table>

Adapted from the Food Safety of Ireland: www.fsai.ie/faq/vitamin_d.html
Table 2

Groups at risk of vitamin D deficiency

- Elderly institutionalised people
- Obesity
- Pigmented skin
- Breastfed infants
- Living below or above 35° latitude
- Chronic renal or liver failure
- Drugs, eg. corticosteroids, carbamazepine, phenytoin, anti-retroviral drugs
- Malabsorption, eg. Crohn's disease, Coeliac disease, pancreatic insufficiency or after gastric bypass surgery or gastrectomy
- Multiparity
- Skin covered completely with clothes or high factor sunscreen
- Little time spent outdoors

References on request

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In Our Lady's Hospital in Navan

Forums
Clinical Review

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