### Vitamins

<table>
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<th>Vitamin</th>
<th>Function</th>
<th>Dietary sources</th>
<th>Causes of deficiency</th>
<th>Risk groups, prevalence</th>
<th>Clinical findings</th>
<th>Screening and management</th>
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</thead>
<tbody>
<tr>
<td>A - retinol, retinal, retinene acid or retinol water</td>
<td>Fat soluble vitamin - Epithelial cell function, vision, immune function, embryo development</td>
<td>Preformed in animal foods (liver, fish, butter, cheese, white milk, egg yolk), canthaxanthin in plant based foods (orange) yellow fruits and vegetables</td>
<td>Low vitamin A content in breast milk, restricted food access, alcoholism</td>
<td>Infants, children, pregnant/lactating women, alcoholism, Intestinal failure, biliary, pancreatic disease, PEM, Anecdotal reports Rouqheyn population</td>
<td>Dry eyes, night blindness, increased infections, hyperkeratotic rash (goose bump rash), Bitot’s spots on conjunctive, corneal ulceration and scarring, blindness, anemia, poor growth</td>
<td>Screen if: Clinical signs deficiency Post arrival in children from refugee camps or situations with poor access to food, or where fat malabsorption suspected. See: Vitamin A guidelines</td>
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<tr>
<td>B1 Thiamine</td>
<td>Water soluble vitamin - role in oxidative phosphorylation and pentose phosphate pathway (Carbohydrate metabolism)</td>
<td>Cereal foods, including wheat germ, wheat bran, wholemeal flour, pork, beef, liver, kidney, legumes, nuts, yeast extract, (Vegetemite), nuts, peas, sesame seeds</td>
<td>Rice based diets, foods with thiaminases/anti-thiamine compounds, Twinits pregnancy lactation</td>
<td>Endemic in areas with rice based diets, anecdotal reports in Karen refugee children pre-arrival with polished rice diet Alcoholism, HIV, jejunal disease (site absorption)</td>
<td>Weakness with intermittent illness, anorexia; irritability; beri-beri - cardiovascular symptoms and/or symmetric peripheral neuropathy, Wernike encephalopathy (confusion, reduced consciousness, ataxia, ophthalmoplegia) Korsakoff syndrome (memory disorder, confusion). - beri-beri and WKS do not usually occur together</td>
<td>Screen if: History weakness with intermittent illness Thiamine deficiency</td>
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<tr>
<td>B2 Riboflavin</td>
<td>Water soluble vitamin - coenzyme in FAD, NAD, fatty acid synthesis, synthesis of B3, conversion B6 to active form</td>
<td>Milk, dairy, fortified bread/cereal, eggs, pulses, green vegetables, almonds, yeast extract</td>
<td>Corn based diets</td>
<td>Corn based diets (Africa, India, parts of China)</td>
<td>Angular stomatitis, cheilitis, glossitis, dermatitis, elevated homocysteine, normocytic anemia</td>
<td>Not usually measured Riboflavin deficiency</td>
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<tr>
<td>B3 Niacin</td>
<td>Water soluble vitamin - coenzyme dehydrogenase-reduce reactions including glycolysis, and fatty acid metabolism</td>
<td>Beans, milk, beef, pork, liver, eggs, wheat, brown rice, fortified bread, vegetables, legumes, nuts, green vegetables</td>
<td>Restricted food access</td>
<td>Restricted food access, rice based diets</td>
<td>Pellagra – dermatitis (hyperpigmented skin and mucosal changes, photosensitivities), diarrhea, dementia, glossitis, anorexia, weakness, irritability</td>
<td>Not usually measured Niacin deficiency – see Niacin</td>
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<tr>
<td>B5 Panthenol</td>
<td>Part of coenzyme A, reactions involving CHO, protein and lipid metabolism</td>
<td>Organ meat, chicken, beef, potatoes, oats, green, tomatoes, eggs, potatoes, green vegetables</td>
<td>Restricted food access</td>
<td>Restricted food access, rice based diets</td>
<td>Very rare – gastromesinal lax, depression, irritability, burning sensation feet, low BSL,</td>
<td>Not usually measured B5 deficiency – see Niacin</td>
</tr>
<tr>
<td>B6 Pyridoxine</td>
<td>Co-factor enzymes in amino transferase reactions inc: ammunoacids and serotonin</td>
<td>All food groups esp. legumes, nuts, wheat, meat, bananas</td>
<td>Restricted food access</td>
<td>Restricted food access, rice based diets</td>
<td>Microcytotic, hypochromic anemia (Heme synthesis), dermatitis, cheilitis, stomatitis, peripheral neuropathy, seizures, LAST and ALT</td>
<td>Not usually measured Pyridoxine deficiency</td>
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<tr>
<td>B7 Biotin</td>
<td>Water soluble vitamin, cofactor for carboxylases</td>
<td>Organ meat, eggs, dairy, synthesis by intestinal bacteria</td>
<td>Anticonvulsants, hemodialysis, pancreatic nutrition large amounts raw egg whites</td>
<td>Haemodialysis, PD dependent patients</td>
<td>Dermatitis, glossitis, atopic eczema, poor growth, anemia, weakness, depression and seizures</td>
<td>Not usually measured Biotin deficiency</td>
</tr>
<tr>
<td>B12 Cyanocobalamin</td>
<td>Water-soluble vitamin - DNA synthesis, branched chain amino acid metabolism</td>
<td>Animal based foods, muscle meat, fish, eggs, dairy, yeast synthesis by intestinal bacteria</td>
<td>Vegan diets</td>
<td>Vomites, restricted food access</td>
<td>B12 deficiency</td>
<td>Consider screen – Iran, Bhutan, Afghanistan, Iran screen in exclusively breastfed infants where maternal deficiency suspected, or where deficiency suspected Vitamin B12 guideline</td>
</tr>
<tr>
<td>C Ascorbic acid</td>
<td>Water-soluble vitamin, antioxidant collagen synthesis, neurotransmitter and carnitine production, enzyme F7</td>
<td>Citrus fruits, broccoli tomatoes, potatoes, berries, guava, mango, capsicum, papaya, parsley, pineapple, spinach and cabbage</td>
<td>Diets without fruit and vegetables</td>
<td>Restricted eating/food access, sometimes seen in autism</td>
<td>Ascorption iron, collagen formation, immune function, wound healing</td>
<td>Screen if clinical signs deficiency, poor food access Vitamin C dosing</td>
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<tr>
<td>D Cholecalciferol (D3) or ergocalciferol (D2)</td>
<td>Fat soluble vitamin - calcium and phosphate balance Bone health, emerging evidence influences cardiovascular health, pregnancy outcomes and immunity/diabetes</td>
<td>Skin synthesis - most important source of vitamin D for all ages, diet is a poor source of vitamin D for all ages, (generally 10 – 25% ) – found in some fatty fish, added to margarine, breast milk content ~25 IU/L, formula 380 – 520 IU/L</td>
<td>Lack of skin exposure to UVB in sunlight</td>
<td>Lack of skin exposure to sun, dark skin Melanogenesis/conditions affecting vit D metabolism inc obesity Exclusively breastfed infants born to deficient mothers, who have at least 1 other risk factor</td>
<td>Bone pain Muscle pain Delayed dental eruption Poor growth Late more milestones Rickets</td>
<td>Screen if at least one risk factor Vitamin D guidelines</td>
</tr>
<tr>
<td>E Selenium</td>
<td>Fat soluble vitamin - antioxidant, protects cell membranes, reg’s prostat gland synthesis</td>
<td>Plant oils, including wheat germ, sunflower, canola, olive, less in corn oil and soy oil</td>
<td>Fat malabsorption</td>
<td>Intestinal failure, bilary, pancreatic disease, PEM</td>
<td>Peripheral neuropathy, reduced DTHR, impaired balance/gait, morphea, pigmentated retinopathy, BRC fragility (aichatrosmes) and haemolyisis</td>
<td>Screen if fat malabsorption suspected Vitamin E dosing</td>
</tr>
<tr>
<td>F Thiamin</td>
<td>Water soluble vitamin, SNSRNA synthesis and amino acid metabolism</td>
<td>Green leafy vegetables, fortified bread/cereal</td>
<td>Restricted food access, Methotrexate, phenytoin and sulfasalazine, cotrimoxazole antagonize folicate utilization</td>
<td>Restricted food access, lack of fresh food intake</td>
<td>Glorosis, stomatitis, poor growth and fetal neural tube defects, Macrocytic anemia, hypernegegmented neutrophils</td>
<td>Screen if clinical deficiency suspected, poor fresh food access, macrocytosis</td>
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<tr>
<td>G Folic acid</td>
<td>Lethal factor in folate - 2, 4, 8, 10 protein C, and f, cofactor for pyruvate carboxylase</td>
<td>Green leafy vegetables, vegetable oils (especially soy) eggs, meat, dairy</td>
<td>Lethal failure</td>
<td>Intestinal failure, bilary, pancreatic disease, PEM</td>
<td>Bleeding/bruising</td>
<td>Not measured, check Hb Vitamin E deficiency</td>
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</tbody>
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**By Vic Evans & Clinical Nutrition team** - reviewed March 2019