

## The Fat-Soluble Vitamins: A,D,E,K

Vitamins are needed by our bodies in small amounts but they have specific functions which no other substance can perform to maintain normal growth, development and regulation of processes. They are essential for life. Each of them has a unique set of symptoms when they are deficient. Vitamins are one of the six groups of essential nutrients: carbohydrate, protein, fat, vitamins, minerals, and water.

There are two kinds of vitamins: fat-soluble and water-soluble. The fat-soluble vitamins are vitamins A, D, E, and K. The nature of being fat-soluble means that these vitamins are transported with fat and stored in the liver and fat tissue. Because they are stored, they can build up and become toxic when eaten in excessive amounts. This mostly occurs when taking single supplements of the fat-soluble vitamins rather than in foods rich in vitamins.

<b><u>Vitamin A</u></b> (Two forms)	<b>Characteristics</b>	<b>Sources</b>
<b>Retinol</b>	<ul style="list-style-type: none"> <li>• Active Form of Vitamin A</li> <li>• Fat-soluble</li> <li>• Can become toxic</li> </ul>	Liver, kidney, meat, eggs, dairy products
<b>Beta-Carotene = most active of plant pigments group call the Carotenoids</b>	<ul style="list-style-type: none"> <li>• Pro-vitamin – can be broken into Retinal</li> <li>• Can be converted into active Vitamin A</li> <li>• Orange pigment in orange and yellow fruits/vegetables and dark green vegetables</li> <li>• Water-soluble</li> <li>• Not toxic</li> <li>• Absorbed better when eaten with fat</li> </ul>	Carrots, winter squash, spinach, sweet potato, pumpkin, cantaloupe, broccoli, egg, mango 
<b>Functions of Vitamin A</b>	<ul style="list-style-type: none"> <li>• <b>Stored in liver and fat tissue</b></li> <li>• <b>Visual Cycle (Retinal)</b></li> <li>• <b>To allow our eyes to adjust to changes from light to dark</b></li> <li>• <b>Cell growth and development</b></li> <li>• <b>Maintain mucous membranes like the GI and reproductive tracts as well as they eyes and nasal mucous membranes</b></li> <li>• <b>Improve immune function</b></li> <li>• <b>Beta-Carotene - Strong anti-oxidant which protects against aging, atherosclerosis, certain cancers, stroke and heart disease</b></li> <li>• <b>Protective anti-oxidant effect is highest in diet high in fruits and vegetables rather than supplementation</b></li> </ul>	



**Cheryl C. Komline, MS, RD**  
 Bernard's Township Health Department  
 Basking Ridge, NJ 07920  
 P. 908.204.3069 F. 908.204.3075  
[www.bernardshealth.org](http://www.bernardshealth.org)

*Contractual Health Agency for:*  
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 Bernardsville Borough  
 Chester Borough  
 Long Hill Township  
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<b>Vitamin D</b>	<b>Characteristics</b>	<b>Sources</b>
<p><b>Several forms:</b> Active form: <b>1,25-dihydroxyvitamin D (Calcitriol)</b></p> <p><b>Supplements:</b> <b>D<sub>3</sub>= Cholecalciferol</b> <b>D<sub>2</sub>= Ergocalciferol</b></p>	<ul style="list-style-type: none"> <li>• Fat- soluble</li> <li>• Serum (blood) levels are best indicator of Vitamin D (Sufficient 25-hydroxyvitamin D &gt;50nmol/L or 20ng/mL)</li> <li>• RDA for children 1 year till age 70 = 600 IU (15 mcg); Over age 70 = 800 IU (20 mcg)</li> <li>• TUL (Tolerable Upper Limit) Adults= 4000 IU (100 mcg)</li> <li>• Made in the skin thru exposure to sunlight – need about 5-30 of 10 am – 3 pm sunlight on exposed skin (without sunscreen) at least two times a week</li> <li>• People with darker skin may reduce the skin’s ability to produce vitamin D from sunlight</li> <li>• People with reduced exposure to sunlight may not produce enough Vitamin D</li> <li>• Some types of liver disease, cystic fibrosis, celiac disease, and Crohn’s disease, as well as ulcerative colitis may reduce absorption</li> <li>• In obese, fat tissue binds some Vitamin D)</li> </ul>	<ul style="list-style-type: none"> <li>• Fatty fish, like swordfish, salmon, herring, mackerel, sardines, tuna</li> <li>• Fortified dairy products, juices, cereals, soy beverages (check labels)</li> <li>• Small amounts in cheese</li> <li>• Added to some margarine</li> <li>• Some mushroom</li> </ul> 
<p><b>Functions of Vitamin D</b></p>	<ul style="list-style-type: none"> <li>• <b>Promotes Calcium absorption</b></li> <li>• <b>Manages Calcium and Phosphorus blood levels to allow for normal bone growth and development</b></li> <li>• <b>Deficiency can cause Ricketts, brittle bones, osteomalacia</b></li> <li>• <b>Along with Calcium, Vitamin D prevents osteoporosis</b></li> <li>• <b>Cell growth, Muscle motility</b></li> <li>• <b>Immune function, Colon Cancer Risk</b></li> </ul>	

<b>Vitamin E</b>	<b>Characteristics</b>	<b>Sources</b>
<p><b>Alpha-Tocopherol</b></p> 	<ul style="list-style-type: none"> <li>• Blood levels controlled by liver</li> <li>• Teens and Adults need 15 mg (22.4 IU)/day</li> <li>• People with some diseases may not digest and absorb enough: Crohn’s disease, cystic fibrosis, and certain rare genetic diseases such as abetalipoproteinemia and ataxia</li> </ul>	<ul style="list-style-type: none"> <li>• Wheat germ,</li> <li>• Oils: Sunflower, Safflower, Corn, Soybean;</li> <li>• Peanuts, Hazelnuts, Almonds, Sunflower Seeds;</li> <li>• Spinach, Broccoli</li> <li>• Fortified Cereals, juices, margarines</li> </ul>
<p><b>Functions of Vitamin E</b></p>	<ul style="list-style-type: none"> <li>• <b>Antioxidant helps to protect cells from the damaging effects of free radicals, both those naturally formed in the body and those from cigarettes, air pollution, and ultraviolet light</b></li> <li>• <b>Boosts immune system</b></li> <li>• <b>Helps blood vessels stay open and prevents clotting</b></li> <li>• <b>Research is conflicting about whether Vitamin E helps in heart disease or cancer and some show that high doses may increase the risk from some cancers like prostate cancer</b></li> </ul>	



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<b>Vitamin K</b>	<b>Characteristics</b>	<b>Sources</b>
<b>Phylloquinone; K1;</b> <b>Menaquinone; K2; Menadione; K3</b>	<ul style="list-style-type: none"> <li>• Made by bacteria that line gastrointestinal tract – long term antibiotics may cause a deficiency</li> <li>• People who take blood thinning drugs (such as anticoagulant/antiplatelet drugs like Warfarin(Coumadin)), may need to limit vitamin K foods – these people should talk to their doctor about taking multi-vitamin supplement without Vitamin K</li> <li>• RDA Adults over age 19: Women: 90 mcg/day Men: 120 mcg/day</li> <li>• Newborns have very little Vitamin K so they get a shot immediately after birth</li> <li>• Vitamin E supplements may interfere with Vitamin K functions</li> <li>• Supplement of ginkgo or garlic may affect blood clotting</li> </ul>	<ul style="list-style-type: none"> <li>• Dark green leafy: kale, spinach, turnip greens, collards, swiss chard, mustard greens, parsley, romaine lettuce</li> <li>• Brussel sprouts, broccoli, cauliflower, cabbage</li> <li>• Dark strawberries</li> <li>• Fish, liver, meat, eggs</li> <li>• Soybean oil</li> <li>• Small amounts in cereals</li> </ul> 
<b>Functions of Vitamin K</b>	<ul style="list-style-type: none"> <li>• <b>Essential for production of protein fibrin which is needed for blood clotting</b></li> <li>• <b>Necessary to make bone and other tissues</b></li> <li>• <b>Cell growth</b></li> <li>• <b>Helps prevent heart disease</b></li> </ul>	

Nutrients do not work independently, they are interdependent. Along with minerals and phytochemicals they have a synergistic effect. This means that the “sum is greater than its parts” or that since they complement and enhance one another’s functions it is best to consume them together. This is always done most effectively by eating whole foods rather than from supplements. Look at the food sources above and you can see that a varied, balanced menu you can get an array of health sustain nutrients and substances that promote health.

*So, choose food and enjoy!*



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