Vitamin A

What is Vitamin A
Vitamin A, also called retinol, has many functions in the body. In addition to helping the eyes adjust to light changes, vitamin A plays an important role in bone growth, tooth development, reproduction, cell division, gene expression, and regulation of the immune system. The skin, eyes, and mucous membranes of the mouth, nose, throat and lungs depend on vitamin A to remain moist. Vitamin A is also an important antioxidant that may play a role in the prevention of certain cancers.

Food Sources for Vitamin A
Eating a wide variety of foods is the best way to ensure that the body gets enough vitamin A. The retinol, retinal, and retinoic acid forms of vitamin A are supplied primarily by foods of animal origin such as dairy products, fish and liver. Some foods of plant origin contain the antioxidant, beta-carotene, which the body converts to vitamin A. Beta-carotene, comes from fruits and vegetables, especially those that are orange or dark green in color. Vitamin A sources also include carrots, pumpkin, winter squash, dark green leafy vegetables and apricots, all of which are rich in beta-carotene.

How much Vitamin A
The recommendation for vitamin A intake is expressed as micrograms (mcg) of retinol activity equivalents (RAE). Retinol activity equivalents account for the fact that the body converts only a portion of beta-carotene to retinol. One RAE equals 1 mcg of retinol or 12 mcg of beta-carotene. The Recommended Dietary Allowance (RDA) for vitamin A is 900 mcg/ day for adult males and 700 mcg/day for adult females. Compared to vitamin A, it takes twice the amount of carotene rich foods to meet the body’s vitamin A requirements, so one may need to increase consumption of carotene containing plant foods. Recent studies indicate that vitamin A requirements may be increased due to hyperthyroidism, fever, infection, cold, and exposure to excessive amounts of sunlight. Those that consume excess alcohol or have renal disease should also increase intake of vitamin A.

Vitamin A Deficiency
Vitamin A deficiency in the United States is rare, but the disease that results is known as xerophthalmia. It most commonly occurs in developing nations usually due to malnutrition. Since vitamin A is stored in the liver, it may take up to 2 years for signs of deficiency to appear. Night blindness and very dry, rough skin may indicate a lack of vitamin A. Other signs of possible vitamin A deficiency include decreased resistance to infections, faulty tooth development, and slower bone growth.

Too much Vitamin A
In the United States, toxic or excess levels of vitamin A are more of a concern than deficiencies. The Tolerable Upper Intake Level (UL) for adults is 3,000 mcg RAE (Table 2). It would be difficult to reach this level consuming food alone, but some multivitamin supplements contain high doses of vitamin A. If you take a multivitamin, check the label to be sure the majority of vitamin A provided is in the form of beta-carotene, which appears to be safe. Symptoms of vitamin A toxicity include dry, itchy skin, headache, nausea, and loss of appetite. Signs of severe overuse over a short period of time include dizziness, blurred vision and slowed growth. Vitamin A toxicity also can cause severe birth defects and may increase the risk for hip fractures.
Vitamin D

What is Vitamin D
Vitamin D plays a critical role in the body’s use of calcium and phosphorous. It works by increasing the amount of calcium absorbed from the small intestine, helping to form and maintain bones. Vitamin D benefits the body by playing a role in immunity and controlling cell growth. Children especially need adequate amounts of vitamin D to develop strong bones and healthy teeth.

Food Sources for Vitamin D
The primary food sources of vitamin D are milk and other dairy products fortified with vitamin D. Vitamin D is also found in oily fish (e.g., herring, salmon and sardines) as well as in cod liver oil. In addition to the vitamin D provided by food, we obtain vitamin D through our skin which produces vitamin D in response to sunlight.

How much Vitamin D
The Recommended Dietary Allowance (RDA) for vitamin D appears as micrograms (mcg) of cholecalciferol (vitamin D3) (Table 1). From 12 months to age fifty, the RDA is set at 15 mcg. Twenty mcg of cholecalciferol equals 800 International Units (IU), which is the recommendation for maintenance of healthy bone for adults over fifty. Table 1 lists additional recommendations for various life stages. Exposure to ultraviolet light is necessary for the body to produce the active form of vitamin D. Ten to fifteen minutes of sunlight without sunscreen on the hands, arms and face, twice a week is sufficient to receive enough vitamin D. This can easily be obtained in the time spent riding a bike to work or taking a short walk. In order to reduce the risk for skin cancer one should apply sunscreen with an SPF of 15 or more, if time in the sun exceeds 10 to 15 minutes.

Vitamin D Deficiency
Symptoms of vitamin D deficiency in growing children include rickets (long, soft bowed legs) and flattening of the back of the skull. Vitamin D deficiency in adults may result in osteomalacia (muscle and bone weakness), and osteoporosis (loss of bone mass). Recently published data introduces a concern that some adults and children may be more prone to developing vitamin D deficiency due to an increase in sunscreen use. In addition, those that live in inner cities, wear clothing that covers most of the skin, or live in northern climates where little sun is seen in the winter are also prone to vitamin D deficiency. Since most foods have very low vitamin D levels (unless they are enriched) a deficiency may be more likely to develop without adequate exposure to sunlight. Adding fortified foods to the diet such as milk, and for adults including a supplement, are effective at ensuring adequate vitamin D intake and preventing low vitamin D levels. Vitamin D deficiency has been associated with increased risk of common cancers, autoimmune diseases, hypertension, and infectious disease. In the absence of adequate sun exposure, at least 800 to 1,000 IU of vitamin D3 may be needed to reach the circulating level required to maximize vitamin D’s benefits.

Who is at Risk
These populations may require extra vitamin D in the form of supplements or fortified foods:
- Exclusively breast-fed infants: Human milk only provides 25 IU of vitamin D per liter. All breast-fed and partially breast-fed infants should be given a vitamin D supplement of 400 IU/day
• **Dark Skin**: Those with dark pigmented skin synthesize less vitamin D upon exposure to sunlight compared to those with light pigmented skin.

• **Elderly**: This population has a reduced ability to synthesize vitamin D upon exposure to sunlight, and is also more likely to stay indoors and wear sunscreen which blocks vitamin D synthesis.

• **Covered and protected skin**: Those that cover all of their skin with clothing while outside, and those that wear sunscreen with an SPF factor of 8, block most of the synthesis of vitamin D from sunlight.

• **Disease**: Fat mal-absorption syndromes, inflammatory bowel disease (IBD), and obesity are all known to result in a decreased ability to absorb and/or use vitamin D in fat stores.

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**Too much Vitamin D**

The Tolerable Upper Intake Level (UL) for vitamin D is set at 100 mcg for people 9 years of age and older (Table 2). High doses of vitamin D supplements coupled with large amounts of fortified foods may cause accumulations in the liver and produce signs of poisoning. Signs of vitamin D toxicity include excess calcium in the blood, slowed mental and physical growth, decreased appetite, nausea and vomiting.

It is especially important that infants and young children do not consume excess amounts of vitamin D regularly, due to their small body size.
Vitamin E

What is Vitamin E
Vitamin E benefits the body by acting as an antioxidant, and protects vitamins A and C, red blood cells, and essential fatty acids from destruction. Research from decades ago suggested that taking antioxidant supplements, vitamin E in particular, might help prevent heart disease and cancer. However, newer findings indicate that people who take antioxidant and vitamin E supplements are not better protected against heart disease and cancer than non-supplement users. Many studies show a link between regularly eating an antioxidant rich diet full of fruits and vegetables, and a lower risk for heart disease, cancer, and several other diseases. Essentially, recent research indicates that to receive the full benefits of antioxidants and phytonutrients in the diet, one should consume these compounds in the form of fruits and vegetables, not as supplements.

Food Sources for Vitamin E
About 60 percent of vitamin E in the diet comes from vegetable oil (soybean, corn, cottonseed, and safflower). This also includes products made with vegetable oil (margarine and salad dressing). Vitamin E sources also include fruits and vegetables, grains, nuts (almonds and hazelnuts), seeds (sunflower) and fortified cereals.

How much Vitamin E
The Recommended Dietary Allowance (RDA) for vitamin E is based on the most active and usable form called alpha-tocopherol. Food and supplement labels list alpha-tocopherol as the unit International units (IU) not in milligrams (mg). One milligram of alpha-tocopherol equals to 1.5 International Units (IU). RDA guidelines state that males and females over the age of 14 should receive 15 mcg of alpha-tocopherol per day. Consuming vitamin E in excess of the RDA does not result in any added benefits.

Vitamin E Deficiency
Vitamin E deficiency is rare. Cases of vitamin E deficiency usually only occur in premature infants and in those unable to absorb fats. Since vegetable oils are good sources of vitamin E, people who excessively reduce their total dietary fat may not get enough vitamin E.

Too much Vitamin E
The Tolerable Upper Intake Level (UL) for vitamin E is shown in Table 2. Vitamin E obtained from food usually does not pose a risk for toxicity. Supplemental vitamin E is not recommended due to lack of evidence supporting any added health benefits. Mega doses of supplemental vitamin E may pose a hazard to people taking blood-thinning medications such as Coumadin (also known as warfarin) and those on statin drugs.
Vitamin K

What is Vitamin K
Vitamin K is naturally produced by the bacteria in the intestines, and plays an essential role in normal blood clotting, promoting bone health, and helping to produce proteins for blood, bones, and kidneys.

Food Sources for Vitamin K
Good food sources of vitamin K are green, leafy-vegetables such as turnip greens, spinach, cauliflower, cabbage and broccoli, and certain vegetables oils including soybean oil, cottonseed oil, canola oil and olive oil. Animal foods, in general, contain limited amounts of vitamin K.

How much Vitamin K
To help ensure people receive sufficient amounts of vitamin K, an Adequate Intake (AI) has been established for each age group.

Vitamin K Deficiency
Without sufficient amounts of vitamin K, hemorrhaging can occur. Vitamin K deficiency may appear in infants or in people who take anticoagulants, such as Coumadin (warfarin), or antibiotic drugs. Newborn babies lack the intestinal bacteria to produce vitamin K and need a supplement for the first week. Those on anticoagulant drugs (blood thinners) may become vitamin K deficient, but should not change their vitamin K intake without consulting a physician. People taking antibiotics may lack vitamin K temporarily because intestinal bacteria are sometimes killed as a result of long-term use of antibiotics. Also, people with chronic diarrhea may have problems absorbing sufficient amounts of vitamin K through the intestine and should consult their physician to determine if supplementation is necessary.

Too much Vitamin K
Although no Tolerable Upper Intake Level (UL) has been established for vitamin K, excessive amounts can cause the breakdown of red blood cells and liver damage. People taking blood-thinning drugs or anticoagulants should moderate their intake of foods with vitamin K, because excess vitamin K can alter blood clotting times. Large doses of vitamin K are not advised.