



# Fat-Soluble Vitamins; serum



**Order:** 999999-9999



**Client #:** 999999

**Doctor:** Sample Doctor

Doctors Data Inc

123 Main St.

St. Charles, IL 60174 USA

**Patient:** Sample Patient

**Id:** 999999

**Age:** 53 **DOB:** 10/26/1965

**Sex:** Male

**Fasting:** Fasting

**Sample Collection**

**Date/Time**

**Date Collected**

12/03/2018

**Collection Time**

1000

**Date Received**

12/04/2018

**Date Completed**

12/26/2018

Vitamin A	Result	Unit	L	WRI	H	Reference Interval
Retinol	26	µg/dL				35 - 100
B-Carotene	5.4	µg/dL				4 - 90
Vitamin E						
alpha-Tocopherol	4.0	mg/L				7.7 - 30
gamma-Tocopherol	900	mg/L				0.1 - 3.8
CoQ10						
Coenzyme Q10	3.5	mg/L				0.5 - 2.5
Vitamin D						
25-Hydroxyvitamin D Total	213	ng/mL				40 - 80
25-Hydroxyvitamin D <sub>2</sub>	52	ng/mL				
25-Hydroxyvitamin D <sub>3</sub>	161	ng/mL				
Vitamin K functional						
Undercarboxylated osteocalcin	10	ng/mL				≤ 9



## Vitamin Comments

- Retinol (vitamin A) is essential for optimal immune function, eye health, vision, and growth. Converted in the body to retinoic acid, derivatives of vitamin A may act as a hormone and affect gene transcription. Zinc deficiency may interfere with Vitamin A metabolism. Vitamin A deficiency may exacerbate iron-deficiency anemia. Chronic alcohol use depletes liver stores of Vitamin A. Vitamin A absorption from the gut may be impaired with conditions of fat malabsorption, including Celiac disease, Cystic fibrosis, inflammatory bowel diseases, biliary tract dysfunction, pancreatic enzyme insufficiency or partial removal of the intestinal tract. Retinol levels less than 10 µg/dL are associated with severe deficiency. The most important clinical effects of severe vitamin A deficiency are found in the eyes (xerophthalmia) and may lead to blindness. Verbal reports of night blindness may be an early indicator of deficiency. Both retinol and retinoic acid are necessary for normal embryonic development. Zinc deficiency may interfere with Vitamin A metabolism. Sources of Vitamin A include diet and supplements. Food sources of Vitamin A include cod liver oils, fortified breakfast cereals, eggs, butter, milk, sweet potatoes, pumpkin, raw carrots, cantaloupe, butternut squash, collard greens, kale, and spinach. Use of Vitamin A supplements in conjunction with pharmacologic retinoids (e.g. Accutane) may increase the risk of Vitamin A toxicity.
- Vitamin E refers to a group of several vitamers mostly known for their anti-oxidant functions. Alpha- and gamma-tocopherol have complimentary activities. Alpha-tocopherol is preferentially retained in the liver and incorporated into lipoproteins for delivery to extrahepatic tissues. Gamma-tocopherol is most prevalent in the American diet, but its level in circulation is normally lower than that of alpha-tocopherol. A high intake of alpha-tocopherol is very often associated with abnormally low gamma-tocopherol. The tocopherols are protective against heart disease, certain cancers, inflammation, ionizing radiation (sun's rays), and possibly Alzheimer's disease. Vitamin E is also a potent vasodilator and inhibitor of platelet aggregation. Vitamin E absorption from the gut may be impaired with conditions of fat malabsorption, pancreatic enzyme insufficiency or partial removal of the intestinal tract.

### Notes:

RI= Reference Interval, L (blue)= Low (below RI), WRI (green)= Within RI (optimal), WRI (yellow)= Within RI (not optimal), H (red)= High (above RI)

Methodology: LCMS QQQ, Enzyme Immunoassay

Dietary sources of gamma-tocopherol include corn, soybean and canola oils, margarine and dressings. Alpha-tocopherol is most abundant in sunflower and safflower oils, olive oil, avocados, sunflower seeds and almonds. Most practitioners recommend supplemental vitamin E products that contain both mixed tocopherols and tocotrienols when supplementation is warranted. Excessive vitamin E can increase the vitamin K requirement and may cause coagulopathy. Concurrent use of anticoagulants, aspirin and supplements such as omega-3 fatty acids may further adversely impact coagulation.

- 25-Hydroxyvitamin D is the major circulating form of vitamin D. It occurs as vitamin D2 (ergocalciferol) and vitamin D3 (cholecalciferol), and is the precursor of the active form 1,25-dihydroxyvitamin D. Because of its long half-life, measurement of total 25-Hydroxyvitamin D (D2 plus D3) provides the best assessment of vitamin D status. The optimal circulating levels of 25-OH D remain a matter of debate. Vitamin D toxicity is rare, and typically occurs with prolonged excessive supplementation. Due to feedback mechanisms one cannot get vitamin D toxicity solely from exposure to UVB light or sunlight. Most patients with toxicity have levels >150 ng/mL (>375 nmol/L). Toxicity usually develops over time because excess vitamin D can accumulate in the body. Common symptoms of vitamin D toxicity include loss of appetite, vomiting, nausea, extreme thirst, excessive urination and itchy skin. Patients with renal failure can have very high 25-OH-D levels without any signs of toxicity, because renal conversion to the active hormone 1,25-OH D is impaired or absent. Thiazide diuretics can increase serum 25-OH D, as might hormone replacement therapy (estrogen). Hypercalcemia, hypercalciuria and hyperphosphatemia are considered to be the initial signs of vitamin D intoxication. Hypercalcemia may be associated with calcium deposits in the arteries or soft tissues resulting in damage to the cardiovascular system and kidneys. It has been emphasized that, because of tight homeostatic control of calcium and phosphorus, when hypercalcemia and/or hyperphosphatemia is apparent following vitamin D supplementation, the process of tissue and/or organ damage may have already been started. One study showed that intake of very high doses of vitamin D in older women was associated with more falls and fractures.
- The level of CoQ10 is higher than expected in this sample. Coenzyme Q10 (CoQ10) is a nutrient that is made in the body and is derived from some foods. CoQ10 is central to energy production via the mitochondrial electron transport pathway. It is also an important antioxidant which protects cells from damage. Toxicity is not usually observed with high doses of CoQ10. A daily dosage up to 3,600 mg was found to be tolerated by healthy as well as unhealthy subjects. However, some adverse effects, largely gastrointestinal, have been reported with very high intakes. The observed safe level (OSL) risk assessment method indicated that the evidence of safety is strong at intakes up to 1,200 mg/day, and this level is identified as the OSL. Side effects from CoQ10 seem to be rare and mild. They include diarrhea, nausea, and heartburn.
- A high serum level of undercarboxylated osteocalcin (uOC) indicates a functional deficiency of vitamin K in the body. Direct assessment of serum vitamin K is not reliable as the levels fluctuate considerably. Vitamin K-dependent calcification of specific proteins, such as osteocalcin, is very important for several physiological functions. Vitamin K is a group of fat-soluble vitamins that are required for blood coagulation, and bone and vascular health. Although relatively rare, symptoms associated with vitamin K deficiency include excessive bleeding from for wounds and punctures, bruising easily, very dark (black) stools, heavy menstrual periods, and prolonged prothrombin time (PT). Vitamin K deficiency may be associated with abnormal calcification of tissues, decreased bone mineralization (density), and increased risk for fracture, heart disease, stroke, and some cancers. Conditions associated with elevated levels of uOC (K deficiency) include: fat malabsorption (Celiac disease, biliary tract dysfunction, IBD, or partial removal of the intestinal tract), liver disease, long-term use of antibiotics, cholesterol-lowering medications, or blood thinners (such as Warfarin), and poor diet. Good dietary sources of K include: dark green leafy vegetables, broccoli, brussels sprouts, and some plant-derived oils (K1), fermented soy (natto) and dairy products (yogurt or raw cheese), meats, fish and eggs (K2). There are no adverse effects of vitamin K with levels found in foods or supplements, or even high dose injections. Caution: Warfarin (Coumadin) interacts with vitamin K. Warfarin is used to slow blood clotting. By helping the blood clot, vitamin K might decrease the effectiveness of warfarin. If taking warfarin it is recommended to have your blood PT checked regularly if vitamin K intake is increased. The dose of your warfarin (Coumadin) might need to be changed.