GENETRACK Diagnostics

Vitamin D

WHAT IS VITAMIN D?

Vitamin D is a fat-soluble vitamin that is naturally present in a few foods, and is produced endogenously when ultraviolet (UV) rays from sunlight trigger vitamin D synthesis. The form of vitamin D from food, sunlight, and supplements is biologically inert and must be converted to 25-hydroxyvitamin D (25-OH vitamin D) then 1,25-dihydroxyvitamin D to be physiologically active (1).

Vitamin D promotes calcium absorption and maintains adequate serum calcium and phosphate concentrations for normal bone mineralization. It is required for normal bone growth and remodeling. Vitamin D also plays a role in the reduction of inflammation, modulation of cell growth, neuromuscular and immune function, and glucose metabolism (2).

SOURCES OF VITAMIN D

Only a few foods naturally contain vitamin D, particularly the flesh of fatty fish (e.g. trout, salon, tuna) and fish liver oils. Beef liver, cheese and egg yolks contain small amounts of vitamin D, but the animal's diet also affects the amount of vitamin D in its tissues (1).

Most of the vitamin D from food sources is through the consumption of fortified foods. Most cow's milk in the US is fortified with ~3 mcg/cup, and in Canada it is mandatory to fortify cow's milk with 0.88-1.0 mcg/100 mL. Plant-based milk alternatives also often contain similar amounts of added vitamin D. Other commonly fortified foods include cereals, yogurt, orange juices, and margarine. The fortification of infant formula is mandatory in both the US and Canada. Dietary supplements are also a source of vitamin D, particularly in infants who are not receiving fortified infant formula (1).

Sun exposure is the source of at least some vitamin D for most people around the world. Type B UV radiation with a wavelength of 290-320 nm penetrates uncovered skin and triggers the synthesis of vitamin D. Various factors influence the amount of vitamin synthesis from sun exposure, including season, time of day, cloud cover, smog, skin melanin content, and sunscreen. This makes it difficult to provide guidelines for sun exposure for sufficient vitamin D synthesis (1).

VITAMIN D REQUIREMENTS

Recommended dietary allowances for vitamin D are based on the assumption that individuals are receiving minimal sun exposure, although sunlight is the major source of vitamin D for some people. Infants require 10 mcg/day, while children and adults from 1-70 years require 15 mcg/day. The recommended dietary allowance for seniors over 70 years of age is 20 mcg/day (3).

VITAMIN D DEFICIENCY

Serum concentration of 25-OH vitamin D is the main indicator of vitamin D status, indicative of vitamin D produced endogenously (triggered by sunlight), as well as vitamin D obtained from food and supplements. Serum levels of 20 ng/mL or more are generally sufficient for most individuals (1).

Diets low in vitamin D are more common in individuals whom have milk allergy or lactose intolerance and those following a vegan diet (3). Low dietary intake, limited sun exposure, and poor vitamin D absorption can result in vitamin D deficiency. In children, this results in rickets, which is characterized by soft bones, skeletal deformities, failure to thrive, developmental delay, and dental abnormalities. In adults, vitamin D deficiency can lead to osteomalacia, which results in weak bones due to defective bone mineralization during the remodelling process. The symptoms of osteomalacia are similar to rickets (4).

Vitamin D receptors are expressed ubiquitously in almost all body cells; hence vitamin D deficiency is also associated with an increased risk of insulin resistance, high blood glucose, diabetes (5), and metabolic syndrome (6,7). This can also contribute to complications that affect the cardiovascular system, increased obesity risk, and hypertension (8).

There is also an inverse relationship between vitamin D levels and inflammation, as lower vitamin D levels are often observed in individuals suffering from inflammatory diseases (9).

POPULATIONS AT RISK OF DEFICIENCY

Breastfed infants are at increased risk of vitamin D deficiency, because human milk alone does not usually provide enough vitamin D to meet adequate intake levels. In addition, the American Academy of Pediatrics (AAP) advises parents to keep infants under 6 months old out of direct sunlight (10), so vitamin D through UV exposure does not usually occur in infants.

Older adults are also at increased risk of deficiency, partly because vitamin D synthesis in the skin reduces with age, and partly due to the fact that older adults are more likely to spend more time indoors (3).

Other populations at increased risk of deficiency include individuals with limited sun exposure (e.g. wear head coverings for religious purposes or have occupations that limit sun exposure) and individuals with darker skin (increased skin melanin reduces vitamin D synthesis) (1).

Conditions that limit fat absorption (e.g. celiac disease, Crohn's disease) reduce the absorption of vitamin D in the gut, as it is a fat-soluble vitamin. Obesity is also associated with an increased risk of deficiency, as the increased subcutaneous fat in obese individuals sequesters more of the vitamin D synthesized from sun exposure (2).

TEST PROCEDURE

Correct specimen collection and handling is required for optimal assay performance.

This test requires a blood sample from a finger prick. All supplies for sample collection are provided in this kit. First wash and dry hands. Warm hands aid in blood collection. Clean the finger prick site with the alcohol swab and allow to air dry. Use the provided lancet to puncture the skin in one quick, continuous and deliberate stroke. Wipe away the first drop of blood (as it may be contaminated with tissue fluid or skin debris). Massage finger to increase blood flow at the puncture site and hold in a position that gravity facilitates the collection of blood on the fingertip. Transfer the blood to the blood collection card or blood collection tube (microtainer).

Avoid squeezing or 'milking' the finger excessively. If blood flow stops, perform a second skin puncture on another finger if more blood is required.

Dispose of all sharps safely and return sample to the laboratory in the provided prepaid return shipping envelope.

Upon receipt at the laboratory, the blood sample is analyzed by the fully automated Alinity i 25-OH Vitamin D chemiluminescent microparticle

immunoassay on the Alinity ci series analyzer. This assay measures 25-hydroxyvitamin D (25-OH vitamin D) levels by binding to anti-vitamin D coated microparticles. The amount of 25-OH vitamin D in the blood sample is measured in relative light units by a chemiluminescent reaction.

TEST INTERPRETATION

This assay will provide an accurate 25-OH Vitamin D level for the tested blood specimen. Healthy serum levels are typically at least 20 ng/mL. A diagnosis of vitamin D deficiency should be made in conjunction with other data, e.g. symptoms, results of other tests, and clinical impressions.

DISCLAIMERS/LIMITATIONS

Certain medications (e.g., Xenical for weight-loss), very high triglycerides, and rheumatoid factors (associated with autoimmune diseases) can affect vitamin D results.

These results should be interpreted in conjunction with other laboratory and clinical information. Further testing in addition to this assay may be required to diagnose vitamin D deficiency.

Additional testing is recommended if 25-OH vitamin D levels are inconsistent with clinical evidence.

Assay interference may occur in specimens from individuals routinely exposed to animals or to animal serum products. Additional clinical or diagnostic information may be required for these specimens.

False results may occur in specimens from individuals that have received preparations of mouse monoclonal antibodies for diagnosis or therapy. Additional information may be required for diagnosis.

Serum specimens containing rheumatoid factor may interfere with this assay. Additional information may be required for diagnosis.

This assay is susceptible to interference effects from triglycerides > 500 mg/dL.

Correct specimen collection and handling is required for optimal assay performance.

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