Vitamin D Complex features 2000 IUs of vitamin D, along with efficacious amounts of the other fat-soluble vitamins, A, E (tocopherols and tocotrienols), and K (K1 and K2). While there are a myriad of beneficial health attributes associated with vitamin D, it should be recognized just how important it is to keep it in balance with these other vitamins. New research is emerging on the intricate interrelationships between them which should make one think twice about dosing any of these suprophysiologically without the others. Focusing on vitamin D without regard to the other fat-soluble vitamins can actually offset the delicate harmony needed for vitamin D to function optimally. Interestingly, what were once thought to be signs and symptoms of vitamin D toxicity are now understood to actually not be toxicities, but rather deficiency symptoms of one or more of vitamin D’s other fat-soluble counterparts. Simply stated, supplementing therapeutic amounts of vitamin D creates a greater need for vitamins A, E, and K.

**D+A**

It has been noted that vitamin D increases the need for vitamin A and that these two vitamins have a collaborative working relationship. For example, the active forms of both A and D are necessary for modulating gene expression. Vitamin D3 (25-hydroxyvitamin D) binds to nuclear receptors that then function as transcription factors to modulate gene expression. Nuclear receptors are intracellular receptor proteins that bind to hydrophobic signal molecules (such as steroid and thyroid hormones) or intracellular metabolites and are thus activated to bind to specific DNA sequences, affecting transcription. The vitamin D receptor forms a complex with the retinoid-X receptor (vitamin A metabolite receptor), and this complex is what binds to DNA to allow for gene expression (control genes by turning them on/off).

Research in osteoporosis shows that in the absence of adequate levels of vitamin D, vitamin A supplementation can contribute to adverse effects such as bone loss. Yet, when vitamin D is present at sufficient levels, this does not seem to occur, once again exemplifying the partnership of vitamins A and D.

**D, A & K**

Researchers have observed that when animals are given very high doses of vitamin D, they present near-identical symptoms as to those seen in a deficiency of vitamin K or vitamin K-dependent proteins. Vitamin A seems to have what is referred to as a “vitamin K-sparing effect,” lowering the expression of these vitamin K-dependent proteins in the absence of sufficient levels of vitamin K, which again can be caused by high intakes of vitamin D. In this model we see that vitamin D increases the expression of proteins whose activation depends on vitamin K-mediated carboxylation; as the demand for carboxylation increases, the pool of vitamin K becomes depleted.

**D+K**

The carboxylation previously mentioned is responsible for the intricate relationships vitamins D and K have on healthy bone metabolism. This is because vitamin K is needed for carboxylation of matrix Gla protein (MGP), which makes it active. MGP is necessary for allowing vitamin D to direct calcium into the bone, and expression of MGP is dependent on vitamin D. Therefore, high vitamin D intake in the absence of adequate levels of vitamin K can increase the risk of calcium deposition in the arteries and other tissues including the breast, rather than in the bone.

In understanding the importance of adequate levels of vitamin K, it should be noted that high intakes of vitamin A can create a deficiency of vitamin K. For example, when rats were given high amounts of vitamin A, serum levels of vitamins E and D dropped; and when vitamin A levels were raised even more, serum levels of vitamin K also dropped. Some rats experienced hemorrhaging, clearly a vitamin K deficiency since K is needed for blood clotting.
Several studies suggest that vitamin E increases the need for vitamin A. Some examples of the protective effects of vitamins A and E together include a research study where rats exposed to gasoline vapors experienced blood poisoning, inhibited growth, and weight loss. Administration of vitamins A and E together produced a significant recovery in all three of these side effects, cultivating greater results than when these vitamins were given independently. A separate study showed increased intake of vitamin A and vitamin E among current and former smokers was associated with better lung function.

In conclusion, it becomes clear that the importance lies in the critical balance necessary for these fat-soluble vitamins to work in harmony and support each other. Health problems can easily occur when one or more of these vitamins are not provided in sufficient amounts. Thus, prescribing therapeutic doses of vitamin D without assuring supportive levels of vitamins A, E, & K can result in deficiency symptoms of one or more of these fat-soluble vitamins.

**Recommended Dose of Vitamin D Complex:**

*Short term:* up to 5 capsules per day;  *Long term:* 1 – 2 capsules per day

If a patient's blood levels of vitamin D are not rising as expected while on their current vitamin D regimen, consider either adding Vitamin D Complex to their protocol or switching to this product for more optimal results.

Vitamin K may adversely interact with anticoagulation drugs known as blood thinners. Patients on these medications should be medically supervised while taking Vitamin D Complex. It is not ideal for these individuals to take high dose vitamin D alone as it may contribute to arterial stiffening (loss of elasticity) since vitamin K is being restricted.

**Fat-soluble vitamin testing (Fat-Soluble Vitamins Profile) is available through Metametrix Laboratory - www.metametrix.com**

**References**


To contact Designs for Health, please call us at (800) 847-8302, or visit us on the web at www.designsforhealth.com.