ADVANCED DOESES OF VITAMIN D ARE REQUIRED TO ACHIEVE OPTIMAL VITAMIN D STATUS, PARTICULARLY DURING THE WINTER

INTRODUCTION

Vitamin D is an essential nutrient that plays a multiple roles in human health. The importance of vitamin D in calcium metabolism and bone health is well recognized but more recently, its role in cardiovascular health, immune function, muscle function, and cell differentiation and proliferation have been defined (1-6). It is well established that vitamin D deficiency leads toickets in developing children but more current research has also linked vitamin D deficiency with osteoporosis, osteomalacia, impaired muscle function, infection, autoimmune diseases, diabetes, and some cancers in adults (1-6). Thus, achieving optimal vitamin D status throughout life is essential to maintaining overall health.

Vitamin D is unique among other vitamins in that very little is obtained through a normal diet. The vitamin D3 is transformed in the skin to form 25-hydroxyvitamin D (25-OH-D) and further metabolized in the liver and kidney to form 1,25-dihydroxyvitamin D (1,25-OH-D) (Figure 1). Hence, supplementation of advanced doses of vitamin D is required to achieve vitamin D status that promotes overall health.

Deficiencies of vitamin D are common. It is currently estimated that more than 1 billion people worldwide and 30-40% of the population between 15 and 49 years of age in the United States suffer from vitamin D deficiency (7-8). Consensus is building that adequate circulating vitamin D concentrations should be greater than 30 ng/mL and optimally above 50 ng/mL (7-10). Because relatively small amounts of vitamin D are obtained through the diet and so many lifestyle factors reduce endogenous vitamin D synthesis, supplementation becomes an important avenue for achieving and maintaining optimal vitamin D status. It has been shown that 100 IU of vitamin D per day increases circulating concentrations of vitamin D by ~1 ng/mL (7-10). Thus, supplementation with advanced doses of vitamin D (2000-4000 IU/day) depending on genotype, are required to reverse vitamin D deficiency, boost vitamin D levels into the optimal range, and maintain them thereafter.

The purpose of this evaluation was to assess the effectiveness of moderately high daily doses of vitamin D3 on increasing circulating levels of vitamin D during winter, spring, and summer seasons. Specifically, circulating vitamin D levels were measured before, during, and after a 12-week course of 4000 IU/day vitamin D3 during the winter followed by a 2000 IU/day dose of vitamin D during the spring and summer seasons.

MATERIALS AND METHODS

Subjects, Study Design, and Serum Vitamin D Status

This was a two-arm, single-blind (subjects blinded only) test involving 19 healthy volunteers from the greater Salt Lake City metropolitan area, most using USANA’s HealthPak® daily dietary supplement pack. Subjects were randomly divided into the treatment (placebo) groups. The treatment group was given a daily supplement providing 4000 IU of vitamin D3 December 15th, 2008 to March 15th, 2009. The control group received a matching placebo tablet. Vitamin D3 and matching placebo tablets were both manufactured at USANA Health Sciences, Inc (Salt Lake City, UT).

RESULTS

- Treatment with 4000 IU/day significantly increased circulating vitamin D levels during the winter and maintained them in the optimal range above 50 ng/mL.
- Circulating vitamin D levels reached maximal levels after 4-weeks of supplementation and plateaued thereafter.
- Upon cessation of supplementation between weeks 12-16, vitamin D levels declined appreciably underscoring the need for continuous supplementation to maintain optimal levels throughout the winter and early spring.
- Supplementation of 2000 IU/day through the late spring and summer maintained vitamin D levels in the optimal range.
- At the conclusion of the study, vitamin D levels in all subjects that did NOT continue supplementation through the summer returned to the baseline values originally measured in December. This result emphasizes the need for continuous supplementation even through the summer when circulating vitamin D levels traditionally peak.

CONCLUSIONS/DISCUSSION

Currently, the RDA for vitamin D is between 200-600 IU depending on age and gender. At baseline, the average intake of vitamin D supplements and diet for the subject in this evaluation was between 600-1000 IU/day, well above the RDA. However, the average circulating level of vitamin D was only 33.4 ng/mL, which is in the adequate range, and significantly above the national average, but did not achieve levels considered to be optimal. Thus, vitamin D supplementation at much higher doses is necessary to achieve recently revised optimal levels.

In this evaluation, supplementation with an additional 4000 IU/day of vitamin D during the winter increased circulating vitamin D4 levels 4 weeks to within the optimal range and maintained them for the duration of the treatment. The subset of subjects who went on to receive 2000 IU/day during the late spring and summer were able to maintain their optimal vitamin D status. Importantly, the subjects in the original supplemented group that did not go on to supplement with 2000 IU/day through the summer, reverted back to their baseline values (or even below) originally measured in December. This was surprising because vitamin D levels at this point in September (end of summer) when endogenous vitamin D production is low. This underscores the importance of continuous supplementation through the summer to maintain optimal vitamin D levels.

The results of this study clearly show that vitamin D supplementation is required to achieve optimal vitamin D levels even when transitioning into the summer months. This is particularly important for individuals who are at risk for vitamin D inadequacy, including pregnant and breastfeeding women, children, and the elderly. The findings of this study support the need for continuous supplementation to maintain optimal vitamin D levels throughout the year.

REFERENCES