



Dr. Michael F. Holick

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Dr. Michael F. Holick on Vitamin D

Vitamin D2 vs. D3

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Vitamin D2 and Vitamin D3 Are They Equally Potent?

During the past several years, there have been two studies Trang et al, (Am J Clin Nutr 68:854-858, 1998); and Armas et al, (J Clin Endocrinol Metab 89:5387-91; 2004) that have raised questions about whether vitamin D2, which is found in some supplements, used in some fortified foods and is the pharmaceutical form of vitamin D that doctors prescribe for their patients, is as effective as vitamin D3 in maintaining a person's vitamin D status, i.e., blood level of 25-hydroxyvitamin D. Trang et al 1998 gave healthy adults 4,000 IU of vitamin D2 or 4,000 IU of vitamin D3 in alcohol for two weeks. A comparison of the blood levels of 25-hydroxyvitamin D after two weeks revealed that there was approximately a 50% difference in the group receiving vitamin D3 (being approximately 50% higher) than the vitamin D2 group. This implied that vitamin D3 was more effective than vitamin D2 in maintaining circulating blood levels of 25-hydroxyvitamin D. Armas et

al 2004 gave a single 50,000 IU dose of either vitamin D2 or 50,000 IU dose of vitamin D3 to healthy volunteers during the summer and observed that the group who received vitamin D2 had a more rapid drop in their circulating blood levels of 25-hydroxyvitamin D. They also observed that the group that received vitamin D2 had a more rapid drop in their blood levels of 25-hydroxyvitamin D3 compared to the placebo group suggesting that vitamin D2 was not only less effective than vitamin D3 in maintaining circulating levels of 25-hydroxyvitamin D, but also that vitamin D2 increased the destruction of vitamin D3.

Based on these observations, physicians, health care professionals and patients have made an effort to find vitamin D supplements that contain vitamin D3. However, in the United States, only vitamin D2 is available as a pharmaceutical preparation, and, thus, patients who are vitamin D deficient and treated by their physicians receive vitamin D2. I treat vitamin D deficiency with 50,000 IU of vitamin D2 once a week for eight weeks. To prevent vitamin D deficiency from recurring, I then put the patient on 50,000 IU of vitamin D2 every two weeks forever. From my experience of over 100 patients on this regime for up to six years, their blood levels are sustained above 30 ng/ml which is considered to be the vitamin D sufficient range. On average, the blood level was between 40-50 ng/ml. Furthermore, an evaluation of their blood calcium, a measure of whether ingesting vitamin D2 at these levels, had caused any toxicity did not change. Therefore, this regime was effective in maintaining my patients' vitamin D status without causing any untoward toxicity.

To determine whether vitamin D2 was as effective as vitamin D3 in maintaining circulating blood levels of 25-hydroxyvitamin D, a study was conducted whereby healthy adults received either 1,000 IU of vitamin D2 or 1,000 IU of vitamin D3 in a capsule once a day in the

winter for 11 weeks. In addition, one group received a placebo capsule and one group received a capsule that contained 500 IU of vitamin D2 and 500 IU of vitamin D3 daily for 11 weeks. Blood levels of both 25-hydroxyvitamin D2 and 25-hydroxyvitamin D3 were determined by state of the art method using liquid chromatography tandem mass spectroscopy. Holick et al, (Vitamin D2 is as effective as vitamin D3 in maintaining circulating concentrations of 25-hydroxyvitamin D, *J Clin Endocrinol Metab* 93:677-681, 2008;) reported that the blood levels of 25-hydroxyvitamin D rose to the same degree in the healthy adults who took either 1,000 IU of vitamin D2 a day or 1,000 IU of vitamin D3 a day for 11 weeks. The group that received vitamin D2 also had their blood level of 25-hydroxyvitamin D3 measured. There was no significant drop in the blood level of 25-hydroxyvitamin D3. To determine whether the mixture of vitamin D2 with vitamin D3 would alter the blood levels of 25-hydroxyvitamin D, the adults who received 500 units of vitamin D2 with 500 units of vitamin D3 also raised their total blood levels of 25-hydroxyvitamin D3 in an almost an identical manner as the adults who received 1,000 IU of vitamin D2 or 1,000 IU of vitamin D3 a day for 11 weeks. The authors concluded that ingesting 1,000 IU of vitamin D2 or 1,000 IU of vitamin D3 a day during the winter (at a time when sun exposure had no influence on blood levels of 25-hydroxyvitamin D) that both vitamin D2 and vitamin D3 were equally effective in maintaining the blood levels of 25-hydroxyvitamin D. Furthermore, vitamin D2 did not have a negative influence on serum levels of 25-hydroxyvitamin D3. Adults who took 500 units of vitamin D2 with 500 units of vitamin D3 had similar increases in their blood levels of 25-hydroxyvitamin D suggesting that vitamin D2 taken with vitamin D3 does not have any negative influence on the metabolism of vitamin D3.

The authors reviewed in their Conclusion several studies that had previously reported that vitamin D2 was as biologically effective as vitamin D3 in both pregnant women and in healthy adults. This study confirms these observations and adds to the body of scientific literature demonstrating that at least when healthy adults take 1,000 IU of vitamin D2, they can be assured that it is as effective as taking 1,000 IU of vitamin D3.