Vitamin D and Potential Health Complications Presented in the Media

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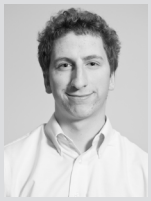

Jesse Place, a third-year chemistry education major with a biology minor, hopes to have a career teaching high school science and increasing student interest in the sciences.

James Polega, a fourth-year student pursuing a degree in biology with minors in chemistry and psychology, hopes to pursue a career as a physician and is currently in the process of applying to medical school.

Erika Prince, a fifth-year senior majoring in biology pre-med with a minor in chemistry, will be graduating in August. She is currently an EMT and will be going to paramedic school in January, then on to medical school in 2015.

Vitamin D, like all other vitamins, is an important part of the well-being of every individual, and yet the media give conflicting reports on the dosage of this vitamin, sometimes stating that Vitamin D supplements can easily cause an overdose. Some sources indicate that up to 50% of individuals may be deficient in Vitamin D (Weir). Media reports on Vitamin D have linked deficiencies to conditions such as heart disease (Tirrell). Lack of Vitamin D in pregnant women has also been claimed to be a causative factor in the development of Type 1 diabetes in their unborn children. Vitamin D has even been claimed to have an impact on the short-term health of an individual by helping maintain the immune system to fight off infections such as the flu. This is cited as the reason that flu season peaks in the winter; the lack of sunlight does not allow for adequate synthesis of Vitamin D (Liu). Clearly, with all of the diseases associated with Vitamin D deficiency, it seems that an individual should ensure that he/she has an adequate supply. However, there is still dispute as to what truly is a proper level of Vitamin D and who is actually at risk for being deficient. Sources have cited everyone from newborn infants to obese individuals to those with darker skin tones as potentially deficient in Vitamin D.

Disputes center around current practices as well, specifically in appropriate dosages for diet supplements. While it would seem obvious that the easiest method to promote general well being would be to simply provide everyone with a Vitamin D supplement, as is done with foods such as Vitamin D fortified milk, some media sources also take issue with this, claiming that Vitamin D supplements can cause a buildup of this fat-soluble vitamin. This build-up could potentially hamper the health of the individual by causing hypercalcemia, a dangerous condition in which excess levels of calcium in the blood can damage many of the body's vital systems, including the kidneys and the skeletal and muscular systems (Cling). Conditions such as kidney stones and atrial fibrillation can result from increased calcium in the blood.

By examining the actual science, particularly the biochemistry, of Vitamin D in the body, it may be possible to determine which if any of the media's claims are valid. All individuals can synthesize Vitamin D naturally, after taking in the precursor molecule 7-dehydrocholesterol. The precursor is then converted into previtamin D by sunshine, specifically UVB rays. It is then isomerized in the skin to Vitamin D. Modifications then occur in the liver and kidneys to convert Vitamin D to its active form 1,25-dihydroxyvitamin D. The synthetic pathway that occurs in the skin allows for a built-in control of Vitamin D, as the Vitamin D that does not bind to a protein to remove it from the skin is degraded by sunlight (Webb 17-25).

In many cases, media reports have been accurate. In the case of child health during gestation, it appears that the media are correct in reporting that Vitamin D is essential to helping prevent potential cases of type 1 diabetes (Shin et al., 1027-1034). Vitamin D regulates the insulin of pancreatic beta-cells and therefore has a direct effect on the level of glucose circulating in the blood. Thus, research has also shown that Vitamin D is indeed important in preserving the health of an unborn child during gestation. A higher level of circulating glucose in mothers during gestation has been shown to increase the child's risk of diabetes later in life.

In reference to the importance of Vitamin D, it appears that media sources were correct again in reporting that adequate levels of Vitamin D are needed to keep an individual healthy. Vitamin D has been identified as a regulatory molecule for the genes which produce cathelicidin (Holick 266-281). Many types of immune cells have been shown to have a Vitamin D receptor. Cathelicidin has been shown to have broad spectrum antimicrobial properties. Evidence obtained about other mammalian cathelicidins suggests that they are able to bind endotoxins and interfere with the cell wall structure in bacteria (Guthmiller et al., 3216-3219). Research has shown that the epithelial cells in the lungs express 1α-hydroxylase, the enzyme needed to convert inactive Vitamin D to an active form. When stressed via infection, these cells cause the conversion of inactive to active Vitamin D, via addition of a hydroxyl group. The increase in active Vitamin D causes a greater level of transcription for the mRNA which codes for cathelicidin, in turn causing an increase in translation and ultimately higher levels of cathelicidin, which is important in the innate immunity of the host organism (Hanshottir et al., 7090-7099).

The final claim that must be examined is that excess levels of Vitamin D can occur via supplement usage, leading to adverse side effects. Vitamin D serves to regulate uptake of calcium in the intestine via the Vitamin D receptor pathway. Binding of Vitamin D to its receptor causes an increase in the expression of the mRNAs for the protein TRPV6. TRPV6 serves as the carrier protein for calcium as it is absorbed in the intestines. In theory, excess levels of Vitamin D taken via supplement could cause higher levels of expression of this protein and thus facilitate an increase of calcium in the body. The increased level of calcium causes shifts in the natural ion concentrations within cells, causing undesirable side effects. When calcium levels in the blood become too high, the secretion of parathyroid hormone is suppressed, which further inhibits Vitamin D synthesis (Nakane et al., 84-89). It has been suggested that it is not Vitamin D that is responsible for this toxicity, but it is in fact a precursor, the molecule 2,5-hydroxyvitamin D, which is common in many supplements. This precursor can bind to the same receptor as Vitamin D, and at high enough levels, can actually saturate this receptor, leading to hypercalcemia (DeLuca et al., 226-230).

It would appear many media sources are fairly accurate in how they describe Vitamin D. It is an important vitamin that is needed for proper development and maintenance of a healthy immune system. While the media also correctly portray that Vitamin D supplements could be harmful, they are actually incorrect in claiming that the harmful ingredient is an excess of Vitamin D. This is not a healthy message to spread as it may cause individuals to fear something that is actually beneficial for them, and cause individuals in need of these supplements to refrain from taking them. Individuals should seek out advice on diet supplements, like Vitamin D, from medical care professionals and not simply from news headlines, if they are to maintain a healthy lifestyle.

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