

# The new role of vitamin D

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Vitamins in general have had bad press recently. This is unfortunate because it tends to obscure the enormous amount of research that has already been done. A great deal more research has been done on most vitamins than on any drug on the market. With this extent of research it is not unusual that there are also many negative studies on vitamins as well as studies with contradictory results. The reason for this is biochemical individuality. Each person is unique and will respond to a drug, and also any nutrient, in a unique way.

The problem with vitamins may be that they are common, over-the-counter items that are viewed as 'just a nutrient' and therefore seem less interesting than drugs that have very clear biochemical effects on the body. The new and exciting research on vitamin D, however, should begin to interest doctors as vitamins begin to find a real place in the practice of medicine.

Vitamin D is a good example of a vitamin that is finding its rightful place in preventive medicine, but is also a good example of how integrative doctors use vitamins in the management of ill health. The focus of integrative medicine is on supporting health and improving function. This approach is not only important in preventive medicine but even more important when a person is ill. If the functional integrity of the body can be improved, spontaneous healing will occur and fewer drugs will be necessary and surgery may even be prevented.

## Vitamin D status

Vitamin D has long been recognised as an essential vitamin for bone health. It is produced in the skin with adequate sun exposure and can lead to severe growth retardation and bone deformities (rickets) if sun exposure is inadequate. It can also be obtained from food, especially fatty fish and eggs.

Commercially, vitamin D is available as vitamin D<sub>2</sub> (ergocalciferol) made from plant products and vitamin D<sub>3</sub> (cholecalciferol) made from animal products.

Cholecalciferol is made naturally in the skin by the action of ultraviolet light (UVB) interacting with precholesterol.

Cholecalciferol is then transported to the liver and turned into 25-hydroxyvitamin D (calcidiol). In a remarkable display of physiological processing, calcidiol is then transported to the kidney where it is converted into the active steroid-like compound 1,25-dihydroxyvitamin D (calcitriol). It is this compound that is excreted into the blood and regulates calcium in the body (absorption from intestines, normal blood maintenance, healthy bones).

The kidney is not the only tissue that is able to convert calcidiol into the active calcitriol. The prostate, breast, colon and other tissues in the body can also activate vitamin D. This function is necessary because calcitriol also helps to regulate gene expression locally.

Suddenly, vitamin D is no longer 'just a vitamin' and a deficiency could have serious effects on the functional integrity of the whole system. There are already reports of vitamin D deficiency contributing to many illnesses, including diabetes, hypertension, heart disease, autoimmune illness and at least 13 different cancers and even some mental illnesses. There is increasing evidence that even autism in children may be connected to vitamin deficiency in the mother during pregnancy.<sup>1</sup>

Vitamin D's depth of action stems not only from its extensive production (in the skin) but also the discovery in 1969 of the nuclear vitamin D receptor present in over 30 tissues/organs of human beings, including the immune systems B and T lymphocytes, hair follicles, muscle, adipose tissue, bone marrow and cancer cells. More recently other 'rapid response' receptors have been identified in the plasma membrane.<sup>2</sup>

Vitamin D is acquiring hormone-like status in the sense that it becomes a steroid-like molecule with hormone functions, with the kidney functioning as a hormone gland.

## Dose and safety

The normal dose and blood levels of vitamin D need to be revised based on recent scientific data. Young white adults make about 20 000 units of vitamin D in their skin within

minutes of whole-body, summer sun exposure. This is clearly a very efficient system and is dependent on people spending some time outdoors, which is not the case for most people in the first world and increasingly for many more millions of people throughout the world who work indoors. In addition, dermatologists' warnings about the increasing skin cancer risk of skin exposure to sunlight has meant that people keep out of the sun, cover up bare parts and use sun blockers on the skin to avoid sun exposure.

People spending time outdoors without many clothes on, such as lifesavers, have levels of around 50 ng/mL. Levels below 35 ng/mL are now regarded as low and not meeting the body's needs for full gene expression and calcium balance, leading to many of the chronic diseases seen today. This is confirmed by the high levels of vitamin D deficiency apparent whenever measurements are made. As much as 70% of the US population has calcidiol levels below 35 ng/mL and 30 to 50% of both the European and US population are vitamin D insufficient or deficient, taking the level of < 20 ng/mL as vitamin D deficiency. Most experts now agree that vitamin D's normal level is > 30 ng/mL.<sup>3,4</sup>

Exposure to sunlight is the best way to obtain vitamin D (exposure is one-third of the time it takes for the skin to become slightly red). A sun lamp is also useful, as are vitamin D supplements. Very few foods naturally contain vitamin D. One would have to eat salmon and mackerel three to five times a week to get sufficient vitamin D and even fortified foods do not contain nearly enough vitamin D because of the fear of taking a fat-soluble vitamin in high doses. These so-called high doses were formulated many years ago. With the knowledge we have today, doses in the range of 2 000 to 5 000 units daily are required to optimise vitamin D levels. Melanin in the skin acts as an effective sunscreen so that dark skinned people need much longer UVB exposure to generate the same 25(OH)D stores.<sup>5</sup>

Vitamin D is stored in the body so that obtaining high levels during the summer by sufficient exposure will usually ensure protection during winter. In obese people, vitamin D is sucked into fat and is not readily available. These people may need more vitamin D than their thinner counterparts. Aging also greatly reduces skin production so that it is exceedingly common to find low levels of 25(OH)D in the elderly, especially if they are living in institutions or confined to bed.

Vitamin D levels can be measured so that excess dosing can be easily detected. Even home kits are now available in some countries. With the high rates of deficiencies, the very low amounts in fortified foods and the fact that even supplements do not contain more than 200 IU of vitamin D, vast numbers of people are deficient and will require between 2 000 to 5 000 IU to bring them up to the normal level.

## Vitamin D and ill health

Integrative doctors are acutely aware that treating a disease requires not only the management of the disease but also the support of health. It is this essential understanding that shifts the focus from symptomatic treatment with drugs to supporting

health with nutrients that emphasise the holistic nature of integrative management. People presenting with hip fractures require the normal medical management, but in addition should be checked for underlying nutrient deficiency problems, of which vitamin D deficiency may be a major factor. In a study of hip fractures in a Swiss population group, severe vitamin D deficiency (below 30 ng/mL) was present in 60% of patients. Eighty per cent were below 50 ng/mL, which some experts believe is not optimal.<sup>6</sup>

LeBoff and colleagues in an earlier study had already documented a 50% prevalence of severe vitamin D deficiency (below 30 ng/mL) among postmenopausal women admitted with acute hip fractures.<sup>7</sup>

Testing for vitamin D deficiency should be part of any integrative investigation, both for the prevention of ill health and the comprehensive treatment of many illnesses. The prescription of drugs, for example to increase bone density, without checking vitamin D status, is clearly not good practice.

Vitamin D status has also been linked to autoimmune disease in humans. In the Nurses' Health Study I and II, women in the highest quintile of vitamin D intake had a 40% reduced rate of developing multiple sclerosis, and in the Woman's Iowa Health Study, vitamin D intake was inversely associated with rheumatoid arthritis.<sup>8,9</sup>

Melamed and his team from John Hopkins University analysed data collected from 13 331 adults during a six-year period and followed up for nine years. People with vitamin D levels less than 17.8 ng/mL had a 26% increased rate of death from any cause, compared to people with the highest vitamin D levels (more than 32.1 ng/mL). They suggest that everyone should monitor their vitamin D levels.<sup>10</sup>

Heart tissue is rich in vitamin D receptors. A recent new analysis of data from the Framington Offspring Study found that low levels of vitamin D may increase the risk of heart attacks, heart failure or stroke by 60%. The research also found that participants with high blood pressure and low vitamin D levels were at a 113% increased risk of a cardiovascular event, as compared to those with normal blood pressure and higher levels of vitamin D.<sup>11</sup>

Other studies have shown similar results<sup>12</sup>. Men with vitamin D deficiency were 143% more likely to suffer from a heart attack. Dobnig and colleagues<sup>11</sup> concluded from their study that "for the first time low vitamin D levels are associated with increased risk in all-cause and cardiovascular mortality. Subjects with low vitamin D levels had higher levels of markers of inflammation".<sup>13</sup>

In a study by Tuohimaa and colleagues which was published in the European Journal of Cancer, more than 400 000 skin cancer patients were reviewed. The study indicated that vitamin D production in the skin "seems to decrease the risk of several solid cancers (especially stomach, colorectal, liver and gallbladder, pancreas, lung, female breast, prostate, bladder and kidney cancers".<sup>14</sup> Similar results have been obtained in other studies.<sup>15,16</sup>

Low levels of vitamin D have been suggested as a risk factor for type 2 diabetes. The study by Paul Knekt and colleagues followed participants for 22 years and found that men with the highest serum D levels were the least likely to develop type 2 diabetes later in life.<sup>17</sup>

Boosting vitamin D levels may also decrease the incidence of depression and positively affect mood. Perhaps this partly accounts for the good feeling generated when one is on holiday and spending time in the sun.<sup>18</sup>

The role of vitamin D on the expression of naturally-occurring human antibiotics, antimicrobial peptides (AMPs), has become evident recently. The presence of pathogenic microbes triggers the conversion of 25(OH)D to 1.25(OH)D, which in turn activates a suite of genes involved in defence.<sup>19</sup>

## Conclusion

The point of this article is not to emphasise the importance of vitamin D, but rather to indicate some principles of the integrative approach in the management of ill health.

The prevention of ill health requires that doctors understand what it means to optimise the functional integrity of the physiological systems of the body. In this article I have emphasised the importance of vitamin D insufficiency and that it may not have a classical presentation easy to diagnose. The reason for this is that most patients do not only have a single nutrient deficiency but a complex of nutrient deficiencies, including, for example, deficiencies of magnesium, vitamin A, C, E and selenium. How these complexes of deficiencies play themselves out is dependent on gene expression and environmental issues, particularly toxins in the environment, cigarette smoking and drugs, which may all drive the process in different directions. One person's vitamin D deficiency may move towards a hip fracture and another towards cancer.

While prevention of disease by optimising health using nutrients and other lifestyle approaches is a major tool of integrative medicine, the same understanding also applies to the management of disease. Behind every disease is a range of dysfunctional systems. It is these dysfunctional systems that are the primary focus of an integrative approach. One of the ways to correct these dysfunctional systems is by optimising function. The simple act, for example, of making sure that vitamin D is not deficient in a patient will go a long way in improving function and health and possibly decrease the need for multiple drug use.

General practitioners are much more in touch with their patients and families than the average specialist and should be aware of the lifestyle habits of their clients. It is not good enough to simply make a diagnosis of disease and treat the disease without a thorough history of diet, stress, exercise and other environmental factors contributing to ill health. The treatment of ill health should always include the optimisation of health. Nutritional deficiencies are a major problem and are a relatively easy way to improve function and help the system move back from dysfunction to improved function and healing.

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