

Revealed: how vitamin D can protect us from cancer

Scientists discover how substance controls actions of genes

By Steve Connor, Science Editor

Tuesday, 24 August 2010

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Vitamin D is produced naturally by the skin but only in the presence of sunlight

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Vitamin D protects the body against a range of serious illnesses by binding to the DNA of the body's cells and directly controlling the genes implicated in diseases such as multiple sclerosis, diabetes and cancer, a study suggests.

It is the first time that scientists have found direct evidence to suggest that the "sunshine vitamin", which is made by the skin in the presence of sunlight, directly controls a network of genes linked with a wide variety of serious disorders.

Although previous studies have linked vitamin D deficiency with a growing list of illnesses, especially the autoimmune diseases such as multiple sclerosis, rheumatoid arthritis and type-1 diabetes, until now scientists have not been able to show how it could trigger so many different disorders.

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The latest study suggests a possible mechanism by showing that vitamin D binds directly to parts of the human genome that house the genes known to be linked with these serious autoimmune disorders, which result from a person's immune system attacking the body's own tissues.

"A surprisingly large number of genes that have been highlighted by gene-associated studies in autoimmunity and cancer seem to be regulated by vitamin D," said Professor George Ebers, a clinical neurologist at the Radcliffe hospital in Oxford.

"This is indirect, but intriguing evidence that vitamin D will prove to be a major player in the key gene-environment interactions that expose us to diseases," Professor Ebers said.

It is estimated that a billion people in the world could be suffering from deficiencies in vitamin D, which can be ingested in the diet in small amounts but is primarily produced by the skin when exposed to direct sunlight, so the findings could have major health implications for people living in northern latitudes with low levels of sunlight.

The researchers, funded by the Wellcome Trust, analysed human cells that had been stimulated by the active form of vitamin D. They found that the vitamin D receptor protein bonded to a total of 2,776 sites along the DNA of the genome. They also found that the vitamin had a significant effect on altering the activity of 229 genes located near to these sites.

"We screened the whole genome and found all the sites where vitamin D binds. The evidence is now quite solid that not only is there binding but we've been able to show that it actually affects the functioning of the gene. It's not just sticking to that region, it's actually altering gene expression," Professor Ebers said.

"We show there's an excess of genes that are associated with a bunch of autoimmune conditions that seem to have the vitamin D regulation feature. I don't think we can say [this is] cause and effect, but it's not a coincidence. It is clearly not there by chance. There's a very substantial bias among these genes that have been highlighted as playing a role in these autoimmune conditions, and that have turned out to be regulated by vitamin D," he explained.

If the study, published in the journal *Genome Research*, is supported by further research it could explain why vitamin D plays such an important role in a wide spectrum of diseases and why people who are native to northern latitudes have over many generations evolved a white skin, which absorbs sunlight more efficiently than darker skin.

"Vitamin D status is probably one of the most powerful selective pressures on the genome in relatively recent times. Our study appears to support this interpretation and it may be we have not had enough time to make all the adaptations we have needed to cope with our northern circumstances," Professor Ebers said.

Sreeram Ramagopalan, of the Wellcome Trust Centre for Human Genetics at Oxford University, said the findings suggest vitamin D supplements may be important. "Vitamin D supplements during pregnancy and the early years could have a beneficial effect on a child's health in later life," he said.

Three ways to get your fix

*Vitamin D is produced naturally by the skin but only in the presence of sunlight. Sunshine contains ultraviolet light B (UVB) which converts a ubiquitous precursor substance in the skin, called 7-dehydrocholesterol, into vitamin D3. This can then be converted by the liver and kidneys into the biologically active form of vitamin D.

The vitamin is also present in relatively high amounts in fish and shellfish, and in lower amounts in eggs and dairy produce. By far the easiest and best way of delivering enough vitamin D to the body is to expose unprotected skin to direct sunlight for a few minutes each day. But light-skinned people are advised not to burn their skin.

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Odysseus 5 hours ago

...and take Vitamin D supplementation in quantities vastly in excess of the RDA. As Professor Ebers suggests, we may not have had "enough time to make all the adaptations we have needed to cope with our northern circumstances" - this is about more than people sticking to the part of the world they have become accustomed to, like all good science it points the way forward rather than dwelling on an impossible and retrograde solution. Everyone should make sure they get enough of the sunshine vitamin, which is easy and cheap (if not free, according to where you live)!

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JA 5 hours ago

This is why people from countries nearer to the equator - many 2nd and 3rd world nations - should not immigrate to Northern European countries, Canada, and other far northern nations which are very far from the equator.

It is clear that if you were born in India, or an Arab country, or Africa, or South America, or another similar nation which is close to the equator, that when you immigrate to a northern latitude you will suffer from a lack of strong sunlight and UV radiation, and thus a major vitamin D deficiency - which causes health problems. You see, those people evolved closer to the equator and thus their bodies are used to high UV radiation and strong sunlight.

Conversely, the opposite is true for Europeans - they should not settle in equatorial countries because the strong UV radiation will wreck their skin and general health. Just imagine a red haired, blue eyed, pale Scottish person trying to settle in Ecuador, right on the equator in South America...they would surely melt!

And this is similar to why you'll find few people from Ecuador or other equatorial country trying to settle in Scotland, or England, or northern Europe in general...they freeze...or if you find people from India or Pakistan living in the UK, they have to spend all winter indoors, and they probably get sick and depressed more often. Conversely, this why you find so few Englishmen in India today for example, despite the long colonization there - it is because India is too hot, too sweltering, too sunny, too close to the equator for Northern Europeans to handle.

People should stick to the parts of the world to which they have become accustomed to living via evolution over many thousands of years.