Sunshine & bugs

GREAT HEALTH
11
Hope Channel Course

SUNLIGHT & INTESTINAL BACTERIA

FUN IN THE SUN

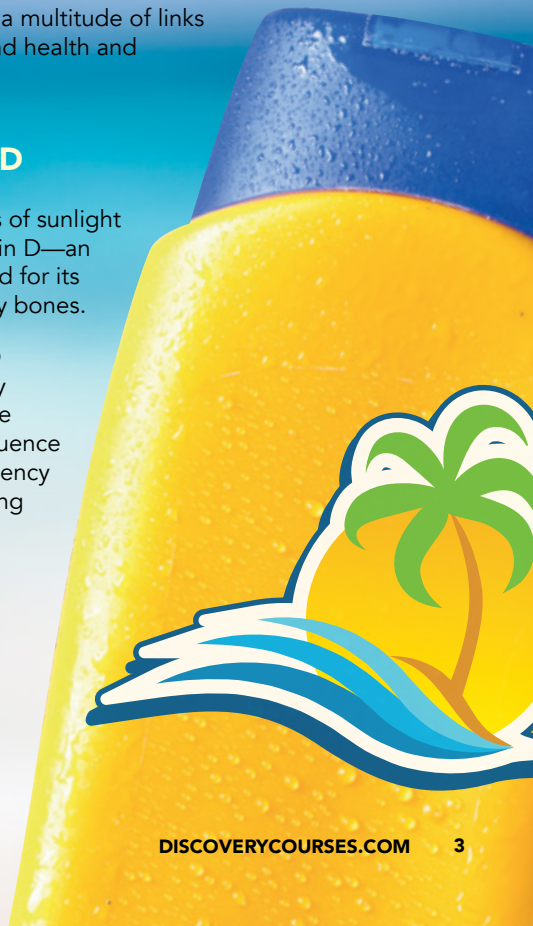
Humans are drawn to sunshine and outdoor living. We love the beach, hiking, camping, sport, and al fresco dining. Over the last decade or two, however, we have come to almost fear the sun—especially in Australia where rates of skin cancer are among the highest in the world.[1,2] We have become good at covering up and protecting our skin, in line with the *Slip, Slop, Slap* sun safety message.

But do we actually need to spend time in the sun? Yes, we do. Research is revealing a multitude of links between exposure to sunshine and health and wellbeing.

SUNSHINE & VITAMIN D

One of the most well known roles of sunlight is helping humans produce vitamin D—an essential nutrient that's recognised for its importance in maintaining healthy bones.

While we can get some vitamin D from food, about 90% of our daily requirement comes from exposure to the sun. However, as a consequence of our sun-smart behaviour, deficiency of vitamin D is becoming a growing world-wide problem.



B.Y.O. VITAMIN D

When ultraviolet B light in sunlight strikes our skin, it activates a substance in our skin known as *pro-vitamin D3*, converting it to *pre-vitamin D3*. This molecule undergoes isomerisation, which means it changes shape, resulting in a change in its properties. It's then released into the bloodstream, and when it arrives in the liver it is further modified into a storage form of vitamin D. When this substance reaches the kidneys, it is finally converted into the biologically active form of vitamin D—the molecule that plays an active role in a variety of functions in our bodies.[3]

The vitamin D that is in food is less biologically active than the type produced in our bodies, and because we can make our own vitamin D, it's often called a *hormone* rather than a vitamin.[4]

It should be noted that as we get older, we have less pro-vitamin D3 in our skin, and this contributes to vitamin D deficiency in older people.[5]

VITAMIN D AND HEALTHY BONES

Vitamin D enhances absorption of calcium from the intestine into the blood stream, to maintain appropriate blood concentrations of calcium. In fact, this is its key focus. If the blood concentration of calcium falls too low, vitamin D will actually stimulate the release of some calcium out of bones and into the blood stream.[3]

By enhancing calcium absorption from food, vitamin D ensures calcium is available to be deposited in bone tissue, helping to keep them strong and protecting against conditions such as osteoporosis in adults, and rickets in children.[4]

The blood levels of vitamin D that are considered optimal are still being worked out exactly, but there are levels that are clearly associated with deficiency symptoms. Almost one-third of Australian adults are believed to have inadequate levels of vitamin D.[6]

VITAMIN D STATUS DESCRIPTION[6,7]	BLOOD LEVEL OF VITAMIN D[6,7]
Excess – results in too much calcium in the blood (hypercalcaemia)	220 nmol/L
Optimal	50–60 nmol/L (still being determined)
Inadequate	<50 nmol/L
Low/insufficient	<35 nmol/L
Mild deficiency	30–49 nmol/L
Moderate deficiency	12.5–29 nmol/L
Severe deficiency	<12.5 nmol/L

Vitamin D—other roles

Vitamin D does much more than help us have healthy bones. We now know that it also regulates the activity of hundreds of genes in the human body, including many involved in neuromuscular (nerve muscle interaction) and immune system functioning. It controls cell growth and differentiation in a variety of tissues, contributing to healthy skin and hair, and protection against cancer.[7-9]

In older people, vitamin D levels below 60–75 nmol/L have been associated with muscle weakness and impaired balance, as well as accelerated loss of muscle mass, strength and physical function.[6] It's important to note that research has found associations between very high vitamin D levels and poor health outcomes, so megadose supplementation is not recommended.[6]

VITAMIN D AND CANCER PREVENTION

Hard as it may be to believe, sunshine via vitamin D helps protect against a variety of cancers, including melanomas. While there is no doubt that melanoma risk is increased by getting sunburnt, there is also significant evidence that appropriate exposure to the sun is protective, with the possible exception of people with red hair.[10] For example, one study found getting sunburnt during childhood strongly correlated with the development of melanoma, but participating in outdoor activities during childhood was protective against melanoma.[11] Research has found that vitamin D specifically protects against skin cell death and damage caused by ultraviolet radiation.[12]

Living at higher northern latitudes, where sunlight intensity is reduced, is linked to an increased risk of dying from a number of other cancers.[8] Research has found evidence that vitamin D in particular protects against prostate[13], colon [14], and breast cancer,[15] and that deficiency of vitamin D may be linked to some types of leukaemia.[16] According to one study, achieving adequate vitamin D levels across whole populations would prevent around 58,000 new cases of breast cancer and 49,000 new cases of bowel cancer each year in the United States and Canada.[17]

VITAMIN D AND DIABETES

Emerging research is finding some interesting links between vitamin D and diabetes. One study investigated people who already had pre-diabetes—where blood sugar levels are above normal. The study found that participants with the highest blood levels of vitamin D had a 48% lower risk of having metabolic syndrome—a condition which increase the risk of developing type 2 diabetes.[18]

Researchers found that people with low levels of vitamin D were significantly less sensitive to insulin—a major risk factor for, and feature of, type 2 diabetes.[19]

Type 1 diabetes, an auto-immune disease, occurs more frequently in populations at higher latitudes.[20] And one study found that children who were deficient in vitamin D had a fourfold increased risk of developing type 1 diabetes later in life.[21]

VITAMIN D AND MULTIPLE SCLEROSIS (MS)

People living at higher latitudes also have higher rates of MS.[22] And a recent study found that MS patients with the highest vitamin D levels had the fewest attacks and slowest disease progression, suggesting the possible benefit of Vitamin D in reducing the severity of MS.[23]

SUNSHINE AND MENTAL HEALTH

The association between gloomy winter days and depression has been well known for a long time. Known as SAD (Seasonal Affective Disorder), it's linked to serotonin, a key brain chemical that helps regulate mood. Serotonin levels are low in people suffering depression, and also in healthy people during winter. Conversely, higher serotonin levels are seen on sunny days.[24,25] A higher frequency of SAD is also seen at higher latitudes.[26,27]

In a recent study, rats kept in the dark for six weeks exhibited depressive behaviour, and also suffered damage in regions of the brain that are under-active in depressed humans. Additionally, neurons that produce chemicals involved in emotion, pleasure and cognition were observed in the process of dying.[28]

Multiple tissues throughout the human body contain receptors for vitamin D, indicating that it performs important functions in a variety of locations.[29,30] Appropriate exposure to the right sunshine is proving to be crucial for good health and wellbeing.

Good & bad sunshine

WHAT IS APPROPRIATE EXPOSURE?

The amount of sunshine we require varies significantly depending on a number of factors, but in general, arms, face and hands should be exposed for 10 minutes each day during summer, and 30 minutes each day during winter.[31]

The type of exposure is also important. The extreme heat of the middle of a summer's day should be avoided, and extra care should be taken on days with a high UV Index.[3] To minimise the risk of skin cancer, don't get sunburnt.

The best sunshine is available mid morning and mid to late afternoon. Try to get some good sunshine every day![32]

BENEFICIAL BUGS

How human are you? It may seem a strange question to ask, but recently scientists have pointed out that our bodies contain ten times more bacterial cells than human cells.[33,34] Many reside in our gastro-intestinal system (also known as the *gut*), and have been referred to as a *newly discovered organ*. The term currently used to describe the complex ecosystem of organisms living in our body is *microbiome*.[35]

Should we be worried that we have trillions of micro-organisms living inside us? In fact, if you have the right kind of bugs, you should be glad! The Human Microbiome Project is looking at connections between changes in the microbiome and changes in human health. According to a senior investigator on the project, "We need to start thinking of ourselves as super-organisms. This is the second genome—the bacterial genomes as well as the human genomes—all of that is part of the true genetic content of a human."[34,36]

High praise is being heaped on our microbiome. "These micro-organisms are not simply passengers or parasites. Many of them are performing functions essential to our health and wellbeing."[37] In fact, it's been estimated that "the microbiome provides more genes that contribute to human survival than the human genome itself provides."[38-40]

Microbes in our gut ferment (digest) fibre and other undigested material such as resistant starch. The by-products include fatty acids, which are beneficial to intestinal cells and have other favourable impacts both within the bowel and in other parts of the body. Microbes in our gut are also an important element of our immune system, with the capacity to both stimulate and suppress immune functioning as required.[41] They also "improve digestion, enhance the absorption of nutrients, make vitamins, improve bowel habits and limit the growth of harmful bacteria."[42]

There are huge individual differences in the makeup of our microbiome. Our personal collection is determined by the microbes we are exposed to, what we feed them, and the developmental stage we are at.[43] For example, in infants a significant factor in microbiome development is breastmilk versus formula milk, and research suggests that babies born by caesarean section miss out on helpful exposure to their mother's microbes.[44,45]

An important element of a healthy microbiome is diversity, and this aspect may be altered by the excessive use of broad-spectrum antibiotics. This is particularly pertinent during infancy and childhood, when populations of different species are just beginning to gain a foothold. A recent study found a significant reduction in the number of beneficial bacteria in infants treated with a broad-spectrum antibiotic, and although the numbers eventually recovered the species diversity didn't.[46]

Can your microbiome keep you slim? Experiments conducted on mice suggest it might. A group of mice were bred and raised in such a way that they were microbe-free—they had no microbiome at all. Efforts to make them obese by dietary methods were largely unsuccessful. Next, the researchers took microbes from other mice—one fat group and one lean group—and implanted them in the microbe-free group. Those colonised with microbes from the fat mice subsequently put on a lot more weight than those colonised from the lean mice.[47] The evidence is mounting for the contribution of an impaired microbiome in the development of obesity, metabolic syndrome, and type 2 diabetes.[48-50]

The human digestive tract is referred to as our *second brain* because it contains 500 million neurons (nerve cells) and can operate independently of our brain. Studies have clearly demonstrated that gut bacteria interact with these neurons, and changes in the bacteria can alter anxiety-like behaviours and memory function. Additionally, signals produced by the metabolic products of gut bacteria can travel to the brain and impact functioning in the central nervous system. For these reasons and more, an unbalanced microbiome is being investigated for its possible role in the development of ADHD (attention-deficit hyperactivity disorder), autism, depression, and other related conditions.[51]

Other lines of investigation include links with inflammatory bowel disease, allergies, cancer, and auto-immune diseases such as type 1 diabetes, asthma and rheumatoid arthritis.

HOW CAN I KEEP MY MICROBIOME HEALTHY?

Because the worlds' populations have already had their collective microbiomes altered by generations of diet and lifestyle changes, scientists aren't sure exactly what a healthy microbiome looks like,[52,53] but they've made good progress in identifying what's common.[34,36] They also have a good idea of what a bad one looks like, and how to avoid it.

EXPOSURE TO GOOD BACTERIA

The right kind of bacteria can be introduced to the intestine by, if possible, breastfeeding infants and avoiding caesarean births. If your gut microbiome has been disturbed, (e.g. by gastroenteritis) you can help get some good bacteria populations back on their feet by eating specialised microbe-containing foods,[54] such as yoghurt and cultured dairy and dairy-alternative foods, and pickled or fermented vegetables (unpasteurised) such as sauerkraut.

SUPPORT GOOD BACTERIA

Populations of good bacteria will flourish if you eat prebiotics—foods that feed good bacteria—which essentially means eating high fibre foods,[55] and an extensive variety of plant foods. Additionally, if possible, avoid excessive use of antibiotics.

There is so much more to our bodies than what we've ever realised. The implications of modern-day living and eating are more far-reaching than we could have imagined. By getting back in tune with how our body needs to be cared for, we can experience profound benefits—many of which we still don't know about.

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