

Hormones: The Inside Story

Episode 3 – Should I take a vitamin D supplement?

This is hormones, the inside story, the podcast from the society for endocrinology where we take a look at the tiny things pulling the strings inside your body.

This time: can you guess which biological molecule we're talking about? Having too little of it has been linked to everything from cancer to coronavirus, heart disease, autoimmune disorders, fatigue, bendy bones and even psychological problems. We can make it from sunshine, but it can be found in foods like eggs and oily fish, or as pills on the shelves of any supermarket or pharmacy. And, depending on who you talk to, is either the most under-rated public health intervention in history, or little more than an overpriced placebo. So this episode we're asking - Should I take a vitamin D supplement?

But first, the elephant in the room - what is a hormone podcast doing talking about a vitamin? Let's find out.

Catherine - Well, it is fairly unique, actually, because it's unique amongst vitamins, certainly because it's actually not a vitamin, *it's a prohormone.*

That's right folks, vitamin D is an imposter!

Catherine - A vitamin is something, a micronutrient which we need to have in our daily diet, without which we'll develop deficiencies and ultimately not be able to survive.

This is Catherine Collins, an NHS registered dietician.

Catherine - As a prohormone, we can make it ourselves with the action of sunlight on skin so it's not technically a vitamin.

A prohormone is basically something that is going to become a hormone.

Catherine - It's not actually taken in the active form. So, whether you eat vitamin C from an orange or a supplement, the vitamin C that you take in is actually going to be used just as it is in your metabolism and by chemical processes. But vitamin D as we take it in diet or get exposed to from sunlight actually has to be transformed by the liver and by the kidney into the active form. So that's why we call it a prohormone, because it isn't actually ready to use as we consume it.

As Catherine said, we can get it from diet, but a major source is sunlight. And the sun isn't beaming down vitamin D directly into our skin, the action of sunlight allows a chemical in our skin to start making vitamin D, which can be activated when we need it.

Catherine - We've got to play around with the vitamin D that we take in, and we sort of "Rubik's cube" it, if you like, into something that's actually going to be used by the body and has a half-life of about 15 hours, so the active form isn't going to be around for forever in our blood stream. It's only as we need it.

It's important that we can store vitamin D, because in the UK we can only make it through the summer - late March to the end of September, and even then, not any sunshine will do.

Catherine - We need a particular wavelength of sunlight in order to do that, not every wavelength helps make vitamin D. And so the particular wavelength we need is a wavelength of 290 to 350

nanometres. And that in the UK is the type of wavelength that occurs in the highest concentration between the hours of eleven and three.

Office jobs are now the norm. Technology means socialising can now be done online without ever needing to leave the house. And as a nation - we might not be getting enough.

Catherine - It is a major issue for a lot of people. Nearly four in ten teenage girls are deficient in vitamin D as are one in six teenage boys, one in six women and slightly similar values really for men as well.

It's not just the less-than-glorious British weather that's to blame for low vitamin D levels - there are a lot of factors. First - that strong midday sunshine that allows us to make vitamin d, is something we are warned to stay away from, with the very real threat of skin cancer.

Catherine - But I think perhaps we've gone a little too far the other way. So I think people are very indoctrinated into the "do not go out in the midday sun", it's obviously the most damaging time to go out in terms of skin health. But actually, it is the time that we do make vitamin D.

So damned if you do, damned if you don't? Catherine says there's always a window of time before you start burning - and we all know exactly what that feels like - that is safe and usually more than enough to harvest your sunshine vitamin.

Catherine - So what we have to do is advise differently, depending on what skin tone you have. So if you have very pale skin tone, you probably make enough vitamin D by being out in the sun for maybe five to six minutes during the sort of peak hours, 11:00 until 3:00. Whereas if you have naturally darker skin, you might need 25 to 30 minutes to actually make the same amount of vitamin D because the skin colour actually makes you protected against burning.

The fact that darker skin means you take longer to harvest vitamin D means that some ethnicities are disproportionately affected by vitamin d deficiency.

Catherine - People from the black and minority ethnic groups, they're at higher risk of vitamin D deficiency because it can take two to three times longer to make the same amount of vitamin D through naturally darker skin than it would from somebody who's very pale skinned.

Other things have an impact too. Some religions or cultures involve covering up most skin. Poverty plays a big role - some people don't have easy access to outside spaces. And older people are less efficient at generating vitamin D. But why is being deficient a problem, what does Vitamin D actually DO?

Zaki - So it's really so known to be very important with musculoskeletal health.

This is Zaki Hassan-Smith, he's a consultant endocrinologist at Birmingham University who studies vitamin D.

Zaki -Yeah, so vitamin D, really the cool thing that we understand is that it helps us to absorb the calcium from the gut which is important for bones.

And the link between vitamin D and bone health is really strong. We know this because if children don't get enough, they can get something called rickets.

These are children who are not thriving. They're of short stature. And they have this characteristic bowing of the legs because there's not the calcium mineral content in the bones. When things get really severe, it can also have so wide ranging effects on their health as well so they have muscle weakness, it can have other effects - even cardiac effects as well.

Like scurvy, rickets feels like a positively Dickensian disease - think of poor Tiny Tim in A Christmas Carol. And in most countries it was consigned to the past... until recently.

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Zaki - Exactly, it seems like a Victorian disease! But it's there, and it's a real public health problem. In terms of poverty and related to malnutrition and that side of things, we still do see it.

In 2019 the levels of hospitalisation from rickets in England were the highest they had been in 50 years.

Because of the risk of rickets, doctors have long advised that breastfed babies should have a vitamin D supplement from birth, and all children from 6 months to 5 years. And for adults, in 2016 Public Health England released guidelines suggesting that everyone should be topping up their Vitamin D intake with supplementation.

Zaki - The advice was they came down to a figure of 10 micrograms of vitamin D intake for everybody on average per day. The way that they came to that figure was it was around kind of preventing the severe disease. So it was felt that taking that amount of vitamin D in a day prevents rickets and osteomalacia in 97.5% of the population. It doesn't really answer what we do with those of us generally well, but wanted to prevent other conditions. . When we think of the kind of public health advice that's out there, a lot of it really is about preventing those severe end of the deficiency.

So if everyone takes this it should help those people who are genuinely and seriously deficient avoid getting rickets - or the adult form - osteomalacia. This is especially important for people who won't get enough from the sun - cover up, have darker skin, work nights or who just don't spend much time outdoors.

Zaki - The other people who should definitely take vitamin D, we think, are people who've had you've got osteoporosis. So they've often got age-related thinning of the bones.

But what about the people who are not at risk of rickets? Because, while the links between Vitamin D and bone strength are well documented, there are other very interesting links emerging to other elements of our health.

Heart health, immune diseases, diabetes infection outcomes - even Covid!

Zaki - What's happened in recent years is that there's been a real explosion of the number of studies that have looked at vitamin D, where there have been associations and links where there's thought to be potential where it might be important with a number of other diseases.

So, when you're reading through the newspapers and the health sections and all of that side of things, I think it's why it's often you read a different vitamin D story each week.

So low vitamin D is associated with, let's say, a bunch of very bad things. But what's tricky is finding out if low vitamin D is actually causing these issues, and would topping up make them any better?

Zaki - Now, where the controversy then comes in, is that really to answer those questions, the highest level of evidence, what we call randomised control trials or meta analyses, which where you look at a number of randomised controlled trials and then look to see if there's an impact of actually replacing vitamin D on that health outcome. And that's where the stumbling block is really. Although there's kind of quite nice basic science data and, you know, strong associations between these healthcare outcomes in the observational side of things, they don't actually confirm that there's causality.

So rather than being the underlying cause of a disease, maybe low vitamin D levels are just an indicator of something else that's gone wrong - having water leaking through the floor of your bathroom isn't caused by a low level of water in your bathtub - but they're both a sign that you've got a problem with your plumbing somewhere that needs to be fixed.

For now, the jury is still out - but we're getting answers. Which is especially pertinent because of COVID 19.

Zaki - There's all sorts of questions that moment around that, you know, because of the you know, there seem to be associations with certain ethnic groups being more affected from severe coronavirus.

Worryingly, people with Black and Asian ethnicities are more likely to develop and be hospitalised by the coronavirus. And these are the same groups who are more likely to be deficient in vitamin D.

And one of the one of the things within the press and within the scientific community that's been sort of raised there is whether or not vitamin D may be playing a role there. And I think it's very early to say that. But there are previous studies that have made similar comparisons, looking at different respiratory diseases and vitamin D. So looking at spread of influenza, or severity of influenza, prevention of influenza or other similar respiratory infections. So I think that we'll see over the next six to 12 months, you'll start to see papers coming out, starting to give us answers on the links there.

And since I spoke to Zaki, papers have started arriving.

Two big studies from the UK Biobank have been released, which found no link between vitamin D and covid rates, but then a few weeks later there was a lot of talk about one study! Some of the headlines were:

"Vitamin D reduces infection and impact of COVID-19, studies find"

"Vitamin D can half risk of fatal coronavirus complications, research finds"

and

"Vitamin D reduces risk of catching coronavirus"

These headlines were all coming from a study in the journal PLOS One, from America. It was getting loads of media attention and it seemed pretty promising. So I gave Zaki another call.

Zaki - I'd be careful not to kind of pull the study completely apart. But again, I think it's really important to be kind of clear on the messaging around that type of study. And it really highlights a lot of the issues that we see around vitamin D research anyway, which is this whole idea of having an observational study. What they've done, they've taken hospital data from 235 patients who were confirmed to be affected with COVID-19. And then what they've done is they've looked at patients who've got 25-hydroxy vitamin D that's thought to be of a sufficient level, and then also looked at patients with the insufficient or deficiency, and then they've taken a range of clinical outcomes, and tried to look at if there are discrepancies between the groups and of all of the things that they found there was a signal with mortality, but again, you know, these are associations, you can't say that, you know, if your vitamin D status is better on the basis of this study, that those patients would have done better or that there are patients who would have had improved chances of survival there.

Again, this doesn't actually show that it's vitamin D itself preventing the worse covid outcomes, but the reporting doesn't necessarily reflect that.

Zaki - Yeah, exactly. It's a nice headline. And that's where I think a lot of this sort of fatigue with the whole vitamin D field sort of sets in because you think, you know, people sort of roll their eyes within the medical field and say "oh no, not another vitamin D story". But to be fair to them, the authors have kind of set that up. Because if you look at the conclusion on the actual paper, they're saying, look, if we improve vitamin D status in the general population, there'll be this benefit, potentially in reducing morbidities and mortalities associated with accruing covid-19 and I don't think you can say that, but it's all hypothesis driven at the moment.

So there's still a lot of work to be done - and it is being done - but at the moment, there's a lot of hype which isn't necessarily backed up. There are lots of other things that could cause increases in Covid 19 severity, including structural inequalities and racism and social factors.

And while the debates continue, some scientists are of the opinion that we've built vitamin D into something it is definitely not.

Tim - The evidence base is just not there.

This is Tim Spector, professor of genetic epidemiology at King's College, London, Head of the Twin Research and Genetic Epidemiology Department.

Tim used to work at an osteoporosis clinic, where he looked into the hormonal factors influencing arthritis.

Tim - At that time was a very strong advocate of vitamin D and gave it to all my patients and wrote a number of papers on vitamin D and various diseases.

But about 5 years ago, something changed.

Tim - I was actually doing some research for my book, The Diet Myth, and looked at the evidence for things like food supplements. I found that although there were thousands and thousands of research papers showing associations with over 100 diseases and low vitamin D levels, whenever there was a randomised controlled trial done, it virtually always failed to show any benefit in people taking the supplements.

Tim found that when you tried to get this cause and effect link, it never worked.

Tim - Low vitamin D levels are probably a marker of general ill health or poor lifestyle, and these factors seem to be general risk factors for all kinds of diseases. There may also be risk factors for poor diet or the general attitude towards health that isn't optimal. So that's why these levels are just low but that doesn't mean it's causal. So we're seeing a mismatch between what the association, observational studies and any actual benefit of giving extra vitamin D to these people.

So unless you are genuinely very low in vitamin D, there's probably not a whole lot more extra that you can get from popping supplements. But according to the NHS, around 1 in 5 people in the UK have low vitamin D levels.

Tim - No two organisations around the world agree what the proper level is to have. Whether it's the Endocrine Society or the Bone Society or the American Clinical Chemistry Society, they've all got slightly different levels of what they call deficient adequate access. And these levels have gradually increased over my career.

So is deficient really... deficient?

Tim - It's an arbitrary line in the sand. We've created a problem that the whole world is deficient in vitamin D and they need supplements. And I just think this has been vastly overblown and that's why we're in this mess at the moment. And it's been driven by, a lot of it, by the pharmaceutical supplement industry that are doing very well out of it. It seems to be everyone's favourite hormone. People are purchasing these extra tablets to take without any evidence that they work.

Tim worries that people might actually be taking too much vitamin D.

Tim - The other problem we're starting to see is that because of marketing, people are taking excess vitamin D, which you can now buy these high dose tablets online, which can give you up to 20,000 units in a single tablet, the normal amount you might take would be 400 or 800 units. So we're talking several-fold these levels. So we have to realise that this isn't a harmless vitamin, it's a hormone, it's

related to the steroid family and you can take too much of it. It can accumulate your fat tissue and cause problems.

So Tim is very much on the side of the vast majority of us do NOT need to worry about taking extra vitamin D from supplements.

Tim - vitamin D deficiency is still a problem in some very poor urban environments with lack of sunshine or if people are told, often wrongly, to avoid the sun and sunlight at all costs. And those people probably do need some protection. But everyone else should probably rely more on the natural ways of getting vitamin D, which you can't overdose from. And that is sunlight and food.

Sunlight is covered if you can get outside enough during the summer. We haven't really discussed food yet - so let's go back to dietician Catherine Collins for her vitamin D buffet suggestions.

Catherine - Well, the food sources are pretty poor, really, and you can get it in animal products and in fish based products as long as there's oil present. In meat, it's present in the meat flesh and in the fat of the meat. It's present in egg yolk, it's present in oily fish like salmon. Or anything derived from oily fish like cod liver oil. And the best sources really are oily fish portions - you can get your daily requirement, about 10mg, from a portion of salmon. But the biggest problem there is that we can't really eat seven portions of already fish a week because it wouldn't be sustainable and also be rather tedious. So, when we're looking at other sources that are naturally occurring, egg yolk and red meat would probably be the main sources.

Not amazing for the vegans among us - but you can actually get a good dose of vitamin D by giving some mushrooms a suntan.

Catherine - Mushrooms are normally grown in the dark. So like humans, if they're not exposed to UV light, they're not going to make very much vitamin D. But we found that if you actually stick mushrooms outside for a little bit, sunbathing between the hours of 11:00 and three over summer, like us, they can actually make some vitamin D.

And sometimes vitamin D can be added in food artificially.

Catherine - From the Second World War, we've added vitamin D to foods. So vitamin D was added to margarine and calcium was added to the national flour, which was the only flour you could buy for bread making or cake making during the Second World War. But a few years ago, the laws were changed so a lot of margarine manufacturing companies no longer add vitamin D to their margarines. But even when they did it, you'd have to have three and a half ounces, 100 grams of margarine, to get three quarters of your daily requirement. So even using fortified foods doesn't really give you your daily requirements that easily. And it requires you to eat foods of a particular type, day in, day out, which most of us don't do.

Catherine says it's difficult to provide vitamin D reliably this way because everyone's diets are just so different. In the same way our skin tone is very different, so we all would need different amounts of sun. It makes giving generalised health advice really really difficult. But, I still asked her to give us some!

Catherine - I think if people got lots of muscle aches and pains, if they know themselves that they don't actually go out in the sun very much or they deliberately try to avoid it, you know, they don't they don't feel comfortable in the sun, then definitely, yes, take a supplement.

And while taking too much vitamin D is possible, and like Tim said, a very bad idea- it's not at all likely with the over the counter levels if you take them sensibly.

Catherine - My previous place of work, it was the only supplement that we dietitians, 15 of us took every day at lunchtime. And we don't really rate vitamin and mineral supplements. It's not products

that we recommend people take routinely unless they feel their diet is compromised. But with vitamin D and with absence of sunlight at the peak times, then yes, you do need to take a supplement.

So that's Catherine's view. And what about Zaki?

Zaki - So no pressure, no pressure from point of view! So I think vitamins are big business. And I wouldn't want anybody to kind of come away from this with this sort of idea that we're saying "look, everybody should everybody take all these vitamins". I think vitamin D is a kind of special case in a way, because basically we know that there's high levels of deficiency. We know that there's high levels of deficiency and we know that there are important health outcomes. And then the other issue with it is it is difficult to get it from diet.

So in the UK, there's a you know, over winter months, you're not going to get any from sunlight. So, again, you might consider a maintenance dose of vitamin D. I think children, it's definitely worth being mindful of that, particularly in the young children who are up to the age of four. And then the other advice, I think the other sort of area that you might think about it would be in pregnancy, really. But there's not a lot of data and not a lot of evidence for multivitamins in other settings. And I'd have cautions around different supplements and minerals and things like that, that haven't got much evidence in terms of translating into health benefits.

So vitamin D is a slippery fish, but what else should we expect from something that calls itself a vitamin when it's actually a hormone?

It is definitely, unambiguously bad to be deficient - if you're at the lower end of the spectrum you can't absorb calcium properly and your bones are going to suffer - rickets is making an unfortunate comeback, especially in poorer areas. So definitely get enough sunshine in the summer if you can - without burning, of course - and you can try and top up with vitamin D-rich foods. Mackerel omelette, anyone? *SFX cooking noises*

But do we need supplements? For starters, this podcast is definitely NOT a substitute for medical advice, so if you're concerned about your health, diet or vitamin levels you should speak with your GP or consult a registered dietician. But unless you go crazy with the amounts, popping a vitamin D supplement is unlikely to do any harm - except maybe your bank balance - especially if you don't have the opportunity to get much sunshine on your skin. But if you have normal vitamin D levels there's not a huge amount of evidence that supplementing will do you any good .. yet. So while vitamin D is important, it's not the miracle solution for all our health ailments that it's sometimes made out to be.

Thanks to Zaki Hassan Smith, Catherine Collins and Tim Spector - his book Spoon fed is out now - for their help this week.

Next time we'll be going to the Olympic Games! How do performance enhancing drugs actually work, will doping ever be allowed, and we meet the man who could really walk the walk.

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