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CASE NOTES

Programme 8. - Vitamins

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PRESENTER:
MARK PORTER

PORTER

Hello. Today's programme is all about vitamins. It's a huge subject, so rather than try and provide a definitive guide to what each vitamin does, I'll be looking at four recent vitamin based controversies from the world of nutrition.

Could taking a daily multivitamin, or cod liver oil supplement damage your bones?

Is folic acid good or bad for your heart?

Should all breast fed children be given vitamin D supplements to protect their long term health?

And why have antioxidants - the heroes of the vitamin world during the '90s - seemingly fallen from grace?

My guest today is David Bender a senior lecturer in biochemistry at University College, London.

David, what differentiates a vitamin from other nutrients in our diet?

BENDER
Really two things. One is we need very small amounts of them, so that's different from protein and essential fatty acids. And secondly, they're organic compounds, let's say they're carbon containing and that differentiates them from the mineral salts that we need.

PORTER
Where does the name vitamin come from?

BENDER
It comes from vital amine because if you go back just about a hundred years ago they were discovered as mysterious, at that time almost unmeasurable, compounds in food that were essential for normal health and development and growth. And the first of them to be chemically identified was chemically an amine and Casimir Funk working here in London coined the term vital amine, which became vitamin.

PORTER
Six weeks ago the Food Standards Agency issued new advice on limiting vitamin A intake, following concerns that consuming too much could weaken bones and increase the risk of the osteoporosis. Advice that could affect millions of people who take daily multivitamin supplements, cod liver oil and/or eat liver at least once a week. Dr Alison Tedstone is head of the nutrition branch at the FSA.

TEDSTONE
The agency's advising that women past the menopause and older men - that's men over 65 - shouldn't take a vitamin A containing supplement and eat liver more than once a

week.

PORTER
And that's because liver is a vitamin A rich food.

TEDSTONE
Yeah liver is where we store our vitamin A and animals store it there too, so it can contain a large amount of vitamin A, much more than any other food.

PORTER
And this is based on what evidence?

TEDSTONE
It's based on epidemiological evidence that's looked at the amount of vitamin A consumed by people and then associated it with a risk of bone fracture in later life.

PORTER
So if you eat too much vitamin A it can accelerate osteoporosis basically is what you're saying?

TEDSTONE
Well it can increase the risk of fracturing your bones. The evidence is not a hundred per cent clear, so that's what - we've issued what's called precautionary advice, so we're basically telling people to think about what they're doing.

PORTER
Any link between vitamin A and osteoporosis is important because of the sheer numbers involved, I think one in three women over 50, 1 in 10, 1 in 12 men over 50 will develop the condition. But also in that age group an awful lot of people are taking supplements, whether they be vitamin supplements or cod liver oil, that are rich in vitamin A and they're eating liver. Does it matter if you're just taking the supplements?

TEDSTONE
It depends. We know that 20% of people take a supplement containing vitamin A and it is possible to overdo it if you're taking say a multivitamin and also having a cod liver oil on top of that that would potentially put you over the 1.5 milligrams.

PORTER
So the advice is clear, if you're taking just a multivitamin, a mineral supplement, that contains vitamin A you're probably alright but if you're doing that and taking cod liver oil and/or eating a diet that's rich in vitamin A you could be putting yourself at risk.

TEDSTONE
That's absolutely true and the only food really to be aware of is liver because that's the only one that really gives you a large hit of vitamin A. Occasional liver consumption is perfectly alright - if you're having it once a month or so - but if you're eating it regularly once a week don't take a supplement on top of that.

PORTER
This advice has come out in the last few weeks, have you spoken to manufacturers, are we going to see anything - labelling products like cod liver oil for instance?

TEDSTONE
We are going to talk manufacturers, meetings have been arranged to discuss possible advisory statements on supplements. We're also taking forward things with the farming industry through the EU about the possible limitation of the amount of vitamin A in animal feeds. That's quite a complicated issue though because there's also the wellbeing

of the animal to consider.

PORTER
Presumably the concern being there that if you give animals reinforced feed that the liver is more likely to be rich in vitamin A as well.

TEDSTONE
That's absolutely it, if the animals are getting a lot of vitamin A then they will store it in their liver and that means that more vitamin A rich liver will come into the human food chain.

PORTER
Dr Alison Tedstone from the Foods Standard Agency.

David, what's the mechanism for vitamin A affecting bone strength?

BENDER
Almost certainly it's because vitamin D, which is essential for the normal turnover of bone, binds to a receptor in the cell and that receptor then binds also to a vitamin A receptor to become active. And that's fine - you've got balanced amounts of vitamins A and D. The nasty bit comes if you have too much vitamin A, then it occupies receptors, binds empty vitamin D receptors, stops the vitamin D binding and stops the vitamin D action. So at high levels vitamin A can actually have an anti-vitamin D action.

PORTER
What about cod liver oil because cod liver oil contains obviously fish oils, plus vitamin a and plus vitamin D and other things, but you can get the benefits of fish oils, for whatever reason again the people may be taking them, without having the vitamin A. I mean if you take conventional fish oil it doesn't contain any vitamin A does it?

BENDER
No, because it's only the liver of the fish that stores and it's specifically cod and halibut store this phenomenal amount of vitamin A.

PORTER
So if you want to get the benefits of fish oils you can go for a non-cod or halibut liver oil and you should be okay?

BENDER
Well a non-liver oil - flesh oil from salmon or herring yes.

PORTER
Right, well I want to move on to vitamin D now. You mentioned it briefly there, it's good for bones, we know that much already from you. Why do we need it?

BENDER
We need it - well the classical need is for the absorption of calcium from the diet and then for control of that calcium in bones.

PORTER
And calcium being the basic building blocks?

BENDER
Calcium's the basic building block, yes.

PORTER

And where does it come from, because we actually manufacture it in our skin don't we?

BENDER
Yes, I mean most vitamin D is almost certainly made as a the result of sunlight exposure. It's present in foods - not in many foods and not in large amounts - so eggs, butter, margarine because it's added, and then oily fish like herring contain reasonable amounts.

PORTER
But it's artificially added to foodstuffs like margarine, that's because we think it's important therefore we need to boost people's intake - is that why?

BENDER
Well the history here is that when margarine was introduced it was replacing butter, so let us replace the nutrients that you would have got from butter.

PORTER
What happens if we don't get enough?

BENDER
Severe deficiency would lead to rickets in children, osteomalacia in adults.

PORTER
And these are weakened, basically deformed weakened bones.

BENDER
Weakened bones yes.

PORTER
And who's most at risk from that?

BENDER
Roughly I would say anyone living north of Watford.

PORTER
What because of the lack of sun.

BENDER
Well it's not the lack of sun but as you go - it really is roughly about Watford - as you go further north so there's very little ultraviolet light at the right wavelength. You see this - it's the wavelength - the same wavelength as tan's you. So if you sunbathe in the south of England, certainly in summertime, you will tan, whereas you won't tan so much further north.

PORTER
And this is because of the angle of the sun, the ultraviolet has to travel through more atmosphere...

BENDER
Yes, it's the angle of the sun, yes.

PORTER
So if you live north of Watford, I mean it's unlikely then most of the UK that we get enough sun exposure to produce enough vitamin D, presumably if you've got dark skin as well that's potentially a problem, even if you live in the south of England, because you've got natural protection.

BENDER

There's possibly a problem with dark skin, yes, that's somewhat less clear.

PORTER
And do we advise at the moment routine supplementation for any particular groups in this country?

BENDER
No, I don't think we do. We have a figure for a recommended intake for housebound elderly, which actually they almost certainly couldn't achieve from food, so they would need to take supplements. But other than that we assume that normal outdoor sunlight exposure is adequate.

PORTER
Professor Nick Bishop, from the University of Sheffield, has a special interest in the role of vitamin D and bone problems in children. He is concerned that, while deficiency and rickets are relatively uncommon, lots of children have lower than ideal levels of the vitamin and that any resultant detrimental effects could extend well beyond their bones.

BISHOP
We've looked at vitamin D levels in the cord blood of babies born in Sheffield at the end of spring and we found that 70% of babies born at the end of spring had levels of vitamin D that are regarded as being in the insufficiency range. So they're not actually having clinical manifestations of vitamin D deficiency, they're not having very low blood levels of calcium at birth and things like that, but certainly the levels that we measured of 20 nanomoles per litre is regarded by some people as sort of a cut off. Seventy per cent of the babies were below that and 90% of the babies that we tested were white. But there have been some interesting studies done in other European countries, particularly those further north. There was a study done by a group in Finland looking back at a group of children born in 1966 and following them through to adulthood, which suggested that those whose mothers had failed to give them the recommended, fairly large, amount of vitamin D, which was I think 2,000 units a day for the first six months of life, that the children who hadn't received that were as adults much more likely to go on and develop Type I diabetes.

PORTER
So this is a problem other than their bone health might be apparently normal but we think that the long term implications of vitamin D deficiency, albeit mild, may be significant elsewhere.

BISHOP
Yes, that's right and because vitamin D is a steroid you have receptors, that is targets, for that vitamin in virtually every cell in your body from your brain, through to your heart, your muscles, as well as your bones and your kidneys.

PORTER
Because there has been some speculation, I think from studies done in Australia, that there may be a link between vitamin D and lifetime risk of developing some types of cancers as well.

BISHOP
Yes, that is true and similarly for - there have been some suggestions about Alzheimer's Disease but it's actually very difficult to disentangle.

PORTER
What's your feeling then about the scale of the problem here in the UK and should we be advocating then routine vitamin D supplementation for all children?

BISHOP
Well certainly white Caucasian children can get vitamin D deficiency, there's no doubt about that and if you go back into the literature at the earlier part of the 20th Century, studies done in American orphanages show that the white children in those orphanages, if they weren't given vitamin D, didn't grow as well as the ones who did receive vitamin D.

PORTER
And where would they get their vitamin D from naturally, I mean obviously they're born presumably with some stores, are they getting it in breast milk and in formula milk?

BISHOP
For breast fed babies, whether they're white or not, it is really quite important that they have some form of vitamin supplementation. Now currently there are two formulations out there that can provide that vitamin D and they're commercial formulations - but they're multivitamin supplements, they're not just vitamin D. We did have NHS drops which had vitamins A, C and D in them but they've been taken off the market and they are currently being reformulated and it's unclear as to when we're going to get NHS drops back again. So we do have a problem in that regard. I think the other problem we have is that there's no clear guidance on what amount of vitamin D should be being given to pregnant mothers. About two years ago NICE produced a guidance note saying there was no evidence that giving vitamin D to pregnant mothers was of any benefit. I think in actual fact that guidance is being revisited currently and certainly the Chief Medical Officer in his most recent pamphlet, sent out to all doctors, suggested that pregnant mothers should have vitamin D if they were thought to be at risk of vitamin D deficiency.

PORTER
What about babies that are fed formula feeds up until a year old or whatever, are the artificial milks that we use reinforced with vitamin D?

BISHOP
Yes they are, but once they stop having formula milk, if they go on to doorstep milk, doorstep milk in this country does not have vitamin D in it.

PORTER
To put you on the spot slightly, I don't know if you have children, but if you now were to have a young baby would you consider vitamin D supplementation in your own child?

BISHOP
I certainly would if the child was going to be breast fed for prolonged periods. And that's exactly what we did with our own children. I would think carefully if I was living in a country where there wasn't much sunshine about whether we'd carry on vitamin D supplementation after the breast feeding stopped or not.

PORTER
It's obviously important to protect young children, toddlers and young pre-school children and in fact all children against damage from UV rays but do you think we might be - are we overdoing it by covering them up too much in the spring and the late summer here in the UK?

BISHOP
Over-exposing youthful skin is a bad thing to do and the instance of skin cancer is much higher in those who've been burnt as children. But the critical thing really to do is to avoid exposure to sun for about two hours either side of midday or one o'clock, depending on whether you've moved to British Summer Time, rather than excluding sunlight altogether. And certainly 10 minutes out in the sun will not do any harm. We

always have trouble catching our children to put sun cream on and so they usually manage to get away for five or 10 minutes anyway.

PORTER
Professor Nick Bishop. You are listening to a Case Notes special on vitamins, I am Dr Mark Porter and my guest is David Bender from University College London.

David, do you share Nick's view that vitamin D insufficiency, as opposed to obvious deficiency, is a problem?

BENDER
Yes, we're getting a lot of evidence now, Nick referred to some of it, that vitamin D's involved in a whole range of activities, quite separate from the classical bone turnover. It's certainly important in the secretion of insulin, so it's a factor in diabetes. It may be a factor in obesity and Type II diabetes. It may well be a factor in many cancers, including prostate cancer.

PORTER
In that vitamin D, good vitamin D levels, may be protective against ...

BENDER
Yes, good levels are protective and our estimates of requirements are based on preventing rickets. So almost certainly appropriate or adequate levels are higher than that. There's a lot of data coming out in the United States now.

PORTER
Well Nick referred to his own data there, suggesting that a significant proportion of young babies are, let's say, insufficient, they don't have enough vitamin D, or don't have ideal levels of vitamin D. Why don't we recommend supplementation during pregnancy and in particular in breast fed children?

BENDER
Well I suppose the answer to this really is we used to. When I was an infant rickets was totally abolished in the late '40s, 1950s, having been called the English disease in the 1920s, because vitamin D was added to everything we were given as infants and toddlers.

PORTER
And it was the English disease because of our climate, partly because of our climate...

BENDER
Yes. So vitamin D was added to everything we had as toddlers and then in the late 1950s a small number of children were found to be particularly sensitive to vitamin D poisoning and they developed - well a few of them died. So there was a decision to reduce the amount of vitamin D added. And then gradually because rickets appeared not to be a problem it slipped off the agenda. In fact if you look over the years people have gone in and about 10% of children, toddlers, in most northern cities where people have looked are marginal to vitamin D, not deficient but marginal.

PORTER
I mean would you consider - I mean is vitamin D poisoning likely to happen if a parent, for instance, a concerned parent, having listened to this item, decides that she will get her son or daughter an appropriate multivitamin supplement for their age and then she sticks to the right dose - is vitamin D poisoning likely?

BENDER
No, at an appropriate level that's fine. The problem in the 1950s was it was added to

rusks and baby milk and whatever else we took and of course we had to swallow our cod liver oil on a teaspoon.

PORTER
Okay, let's move on to one of the B vitamins - folic acid. And we know that folic acid protects babies against spina bifida and related conditions when taken during early pregnancy. But there is also been a belief held by some experts that folic acid could protect adults against stroke and heart attack.

But the very latest research, including a recent study in Norway, suggests that the vitamin - which is found naturally in foods like leafy green veg and wholegrains - offer no such protection against stroke and heart attack - indeed, in some cases high intakes may actually be detrimental.

All of which is very confusing for Barry Smith who had a coronary artery bypass operation 10 years ago. Caroline Swinburne caught up with Barry and his wife Lynn at their home in Colchester.

ACTUALITY
I can't find any mushrooms.

Oh dear this is always happening.

LYN
This is our menu on the kitchen wall. We have sort of a seven day programme so that we're not having too much red meat or too much cheese and that we do have enough fruit and vegetables. Today, Monday, is vegetable kebabs and rice, followed by fresh fruit salad.

ACTUALITY
I'll wash ...

.. in the vegetable rack.

Yeah, I'll get the tomatoes out and wash those. And also the courgette.

BARRY
Directly after the bypass I was given a diet sheet. We were given sort of three columns and one of the columns was you can eat as much as you like of these - and fruit and vegetables were in that column which you can eat as much as you like. Weren't sort of told exactly how much to eat but you just could eat as much as you like.

LYN
Obviously lots of fruit and vegetables and also grains and lentils and all those sort of things are all very good too. And sort of brown bread and brown rice as alternatives to the more processed things.

SWINBURNE
Did they give any reasons for why fruit and vegetables were good?

LYN
I don't know, I think it's just common sense, everybody knows that fruit and vegetables are good for them don't they, it's perhaps you just don't always eat as many as you should.

BARRY
What I was told was that my problem was furring up of the arteries and the cholesterol

and fat had a big bearing on that and to eat fruit and vegetables would help to keep the arteries that I've got free - free and also reduce the amount of cholesterol in the blood.

SWINBURNE
Fruit and vegetables - as well as pulses and brown rice - contain high levels of folic acid and B vitamins. These micronutrients help decrease levels of a substance called homocysteine. It's thought that high levels of homocysteine may be linked to heart disease, increasing the rate at which arteries get furred up and clots develop.

So should people think about taking these vitamins in a supplement, to help reduce their risk of heart disease and stroke?

Morris Brown, is a professor of clinical pharmacology at the University of Cambridge and consultant physician at Addenbrookes hospital. He's been involved in one such study.

BROWN
We recruited a group of almost two thousand patients who were known to have coronary heart disease. One group received a placebo tablet - a dummy tablet - the other group received a high dose - 5 milligrams - of folic acid and each patient remained in the trial for two years. And the question we asked was whether the patients randomly assigned the folic acid would have a lower incidence of either further heart attacks or death from any cardiovascular cause or what we call an unplanned coronary artery revascularization, whether surgery stenting or angioplasty.

SWINBURNE
But the results weren't quite what was expected.

BROWN
The primary result of the study was that when we looked at all the things which might happen to the heart or arteries in these patients there was no difference between the groups. The patients on folic acid neither had more or less of these events. There was some variation in the individual events, namely heart attacks or deaths or arterial surgery, and the patients having, what we call, non-fatal heart attacks, these occurred slightly more often in the patients receiving folic acid than those receiving dummy tablets.

SWINBURNE
The results of a larger study along the same lines in Norway have just been published. This showed a small but definite increased risk of heart attacks and strokes for patients who took the tablets - especially in those who took both folic acid and vitamin B6.

Quite why this should be is still unclear as the homocysteine levels were shown to have dropped as predicted.

ACTUALITY
Right, they need turning don't they?

SWINBURNE
Barry Smith says such uncertainty is troubling and symptomatic of a more general confusion over dietary advice given to heart patients.

BARRY
It does worry me if some advice like that has been given and then it's found to be counterproductive. But one does hear of different advice like chocolate was bad for you and now in small amounts it's good for you and so on. So I guess it depends on the amount of research that's been done.

SWINBURNE
There is clearly much work left to be done. Professor Brown is now collaborating on a larger study, to try and detect smaller benefits from B vitamins, especially in patients with abnormally high homocysteine levels.

Meanwhile, the advice remains to eat a healthy balanced diet, including as much fruit and vegetables as possible.

BROWN
There's much more in fruit and vegetables than folic acid, of course there is. There's various possibilities about why a vitamin treatment may be less effective than dietary advice. One is that the fruit and vegetables has more than one beneficial thing in it, the other is that the vitamin is doing a mixture of good and bad and if the vitamin's been taken on its own then the bad may offset the good. So that all remains speculative at the moment. But I think the dietary advice remains to increase intake of fresh fruit and vegetables, that, as far as we know, is entirely safe and pretty good evidence that it's effective. There have been, since we started our trial, more trials of so called Mediterranean diet which have been very effective in reducing risk of heart disease or further heart disease in patients who've already suffered. So that should remain the primary advice to these patients.

PORTER
Professor Morris Brown talking to Caroline Swinburne.

David, I want to finish off with a look at the current thinking on antioxidants like vitamins C and E. Now during the '90s of course it was thought that very high doses of these would protect against a range of problems including heart disease, but they have not lived up to the promise have they? First of all perhaps we should start, what are antioxidants?

BENDER
Right what they're doing is they're mopping up the highly reactive oxygen radicals that are formed in normal metabolism just by breathing. And they mop them up and they form stable radicals that last long enough to become non-radicals by metabolic - by chemical reaction.

PORTER
So they get broken down.

BENDER
They get broken down.

PORTER
And if these free radicals are left to their own devices they damage the tissues - in what way?

BENDER
Yes, left to their own devices they will damage DNA in the nucleus which may lead to cancer, they will oxidise your blood lipids which is likely to cause or be a factor in atherosclerosis and heart disease.

PORTER
Blood lipids being cholesterol. So they accelerate the furring up of your pipe work basically.

BENDER
Yes, yes that's right.

PORTER
They've not really lived up to their promises have they.

BENDER
No they haven't. I mean the epidemiology was beautiful that people with high blood levels of carotene, vitamin E, vitamin C, reflecting high intakes, suffered less cancer, less heart disease.

PORTER
That was pretty convincing.

BENDER
That was very convincing yes. So people set up some major intervention studies giving large groups of population supplements or not. The big beta carotene study in Finland, more people receiving the protective beta carotene died of lung cancer. The big carrot study - that's carotene and retinal efficiency not carrots as in eat carrots - in the United States was stopped early because of excess death. Earlier this year there was a meta-analysis looking at all the published papers on vitamin E supplement was published, okay there were controversies about that but the take home message is the higher the dose of vitamin E used in various intervention studies the more people died.

PORTER
So we know that people with high levels of these vitamins seem to have some protection against things like cancer and heart disease, yet when we give people these vitamins in an attempt to boost theirs, we do not get the same effect, indeed they seem to fare worse.

BENDER
Yes.

PORTER
Can you briefly explain why that might be or why you think it might be?

BENDER
Yes, let's start with the good side. If your levels of antioxidants are high from food it means you're eating large amounts of fruit and vegetables with plenty of other protective things in. If you take a supplement of antioxidants then I said a minute ago they act because they form a stable radical that lasts long enough to become an unradical by chemical reaction. That radical is also stable enough to penetrate deeper into tissues and do more damage. So it may be by taking a high level of vitamin E or carotene you're actually making things worse rather than better.

PORTER
Big question - do you take any supplements?

BENDER
I got very convinced by the epidemiological data on vitamin E ...

PORTER
During the '90s.

BENDER
During the '90s yes and I started taking vitamin E supplements. And then in the mid-1990s the Cambridge Heart Anti-Oxidant Study was published which showed more people taking vitamin E died from fatal heart attacks. And I stopped taking supplements.

PORTER
Dr David Bender, thank you very much.

This is the last programme in the current series, but we'll be back for an extended run in the New Year and we'd like to hear from you about any issues you think we should be covering.

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