FISH OIL

Essential for Hearts, Brains and Health

Our understanding of the role of fats and oils in our diet is continually evolving. For decades we were told that all fat is bad for us, and fat free diets were all the rage. Eventually the information filtered through that not all fats are the same, and that many fats and oils are essential to our health.

We are now continually refining which fats are good for us and which may not be so helpful: where once it was saturated fats (such as butter) vs. unsaturated fats (such as olive oil and fish oil), now it has become clearer that both of these have their place, and that it is the quality of the oils we need to be looking at.

What has ceased to be in doubt for a long time now is that fish oil is one of the "good" guys. The omega 3 oils in fish oil, now known to be essential to our diet, have been shown to benefit everything from arthritis to Attention Deficit Hyperactivity Disorder (ADHD), schizophrenia to heart health.

OMEGA 3 OILS

The omega 3 oils in fish oil are part of a group of oils known as essential fatty acids (EFAs), unsaturated fats or polyunsaturated fats (PUFAs). A closer look at the PUFAs in fish oil shows them to be crucial for the health and proper function of every cell in our body.

The unsaturated fat content of our cell membranes determines how flexible each cell is and the ease of movement in and out of the cell. This determines how efficiently toxins (such as metabolic waste) can be removed. The level of unsaturated fats in our cell membranes also affects how much energy each cell can produce to power almost everything it needs to do, as well as each cell's ability to communicate. All of this ultimately influences the health and behaviour of each of the hundred trillion cells that our bodies contain.

In addition, omega 3 oils are used to make a series of prostaglandins, or tissue hormones, that combat inflammation. Women also need to be able to make a range of appropriate prostaglandins in order to regulate menstrual cycles and pregnancy, and to stimulate uterine contraction in childbirth. This is one of the reasons why essential fatty acids are so crucial during puberty and pregnancy, in addition to their role in making healthy new tissue cells in the developing foetus and in the lining of the womb. The omega 3s in fish oils are a fundamental factor in how well our brain and nervous system work, the health of our reproductive system, the make-up of our skin, blood vessels, lungs, heart, digestive tract and, well, pretty much everything really. We are often told that proteins are our building blocks that make up all the different structures in our bodies, but oils have an equally vital role, and the omega 3 oils deserve special attention.

TYPES & SOURCES OF OMEGA 3 OILS

Omega 3 oils are found in marine sources such as fish and krill, and also in nuts and seeds, particularly flax seeds. Meat, dairy and eggs also contain some levels of omega 3 for the same reason that humans do – it is present in the cell membrane – but the quantity will depend on the health and diet of the animals concerned.

Not all omega 3 is the same, however. Flaxseed oil is often described as the vegetarian option for a good omega 3 source, but the structure of the omega 3 in flaxseed oil is different to the structure of the omega 3 oils in fish.

Flaxseed oil is rich in alpha-linolenic acid (ALA), which which is sometimes called the parent form. In order to fully utilise ALA we need to convert it to EPA (eicosapentaenoic acid) and DHA (docosohexaenoic acid), which are the longer chain forms of omega 3 found ready made in fish oil. The conversion process requires a lot of criteria to be in place, including the correct pH of the cell and its environment and an enzyme called
D6D.

Flaxseed oil will only be a good vegetarian substitute for fish oil if the person taking it is sufficiently converting the ALA to EPA and DHA. Our efficiency in doing so has been in question for some time, and one review suggests that our conversion rate is less than 5-10% for EPA and 2-5% for DHA[1]. Others have suggested that it depends on location, so that people living in areas where there has traditionally been a reliance on fish for omega 3 intake, for example, would naturally produce less D6D and so have a lower conversion rate.

In northern Europe most of us originally lived in coastal regions, so we would have been eating a mixture of fish, providing EPA and DHA, and nuts and seeds that we needed to convert. So our ability to convert the oils in flaxseed oil, for example, would perhaps be better than people living in Antarctic regions, but not as good as if we had traditionally been living inland with less access to fish and more reliance on nuts and seeds.

Our ability to convert oils will undoubtably differ from person to person, too, depending on the energy, resources and internal conditions available to each individual. Our ability to produce the D6D enzyme, for example, can be blocked by a long list of factors, including alcohol, caffeine, environmental chemicals and carcinogens, hormonal imbalances including elevated stress hormones, radiation and transfats[2]. We also need good levels of iron, magnesium, zinc, melatonin and vitamins C, B3 and B6 in order to make D6D[3].

As modern, stressful lifestyles and diets as well as polluted environments can affect our ability to convert our omega oils, many of us would perhaps find benefit in increasing our levels of EPA and DHA, the converted long chain omega 3 oils. Both fish oil and krill oil contain EPA and DHA: fish oil tends to have a higher concentration of these, although krill oil contains them in phospholipid form, which means that their bioavailability is much higher[4]. Essentially, the EPA and DHA found in krill oil are much more easily absorbed in the small intestine, and they slot into the cell membrane and the membrane surrounding the cell's nucleus much more easily.

OMEGA 3 VS OMEGA 6

We also need to be aware that omega 3 oils compete for absorption with omega 6 oils, the other essential fatty acid we need in our diet. If we have too much omega 6, then we don't absorb omega 3 very efficiently, and vice versa (except that it's rarely the other way round). We get omega 6 oils predominantly from nuts and seeds, as well as animal sources such as meat, dairy and eggs, and like omega 3 oils, they help allow substances to be transported across the cell membrane.

Omega 6 oils have various roles in the body, and are particularly beneficial for the skin. While omega 3 oils are used to produce anti-inflammatory prostaglandins, however, omega 6 oils are often used to make prostaglandins that stimulate inflammation in the body. So if we have too much omega 6 and not enough omega 3, it can be hard for our bodies to regulate inflammation and keep levels down. This may be relevant for conditions ranging from eczema, asthma and arthritis to mental illness and cancer.

OMEGA 6/OMEGA 3 RATIOS

So how much is too much omega 6? There are differing opinions on what the original ratio would have been with traditional diets, but again it would probably have varied from region to region. Estimates range from 4:1 in favour of omega 6, to 1:1, i.e. equal amounts. Current intake, however, is usually between 10:1 and 25:1, which means that our average omega 6 intake is way too high[7].

There are various reasons for this, including the fact that many of us now use oils high in omega 6 for cooking, omega 6 rich margarines have become hugely popular, our fish intake is much lower than it would have been in the past, and the balance of essential fatty acids in our meat, eggs and dairy has also changed. The ratio of omega 6 to 3 in animal products should be similar to our own ideal ratio, but the diet of farmed animals has changed substantially over the years, and so the levels of omega 6 are often around 25 times higher. Animals fed predominantly on wild pastures are much more likely to have a more balanced ratio, as are chickens fed a variety of seeds rather than just grains. So those who choose to eat meat have an additional reason for preferring free range organic options and game.

Research suggests how these very high levels of omega 6 in our diets, especially compared to omega 3, promote the development of many diseases, including cardiovascular disease, cancer, and inflammatory and autoimmune diseases, while increased levels of omega 3 and a change in the ratio exert suppressive effects. One study shows that the secondary prevention of cardiovascular disease, a ratio of 4:1 was associated with a 70% decrease in total mortality. A ratio of 2.5:1 reduced rectal cell proliferation in patients with colorectal cancer, whereas a ratio of 4:1 with the same amount of omega 3 EFA had no effect. The lower omega 6/omega 3 ratio in women with breast cancer was associated with decreased risk. A ratio of 2-3:1 suppressed inflammation in patients with rheumatoid arthritis, and a ratio of 5:1 had a beneficial effect on

patients with asthma, whereas a ratio of 10:1 had adverse consequences.[8] These findings suggest that we would do well to keep our ratio of dietary omega 6 to 3 at 5:1 or lower.

DIGESTING OMEGA 3

In order to be able to absorb fish oil (or any oil) effectively from the small intestine into the lymph and bloodstream, we need good levels of bile, which is produced by the liver and released by the gallbladder. The bile helps to emulsify fats so they can travel more easily through our bodily fluids. If our liver and gallbladder aren't up to the job, then we are more reliant on dietary emulsifiers such as lecithin. We also need the wall of our small intestine to be healthy and fully functioning, which requires, among other things, good levels of zinc and essential fatty acids, such as the very omega 3 oils we are seeking to absorb.

Once in the lymph and bloodstream, lipoproteins are formed, a mixture of lipids (fats) and proteins that transport the fats to where they need to go. Dr. Johanna Budwig, in her groundbreaking work on flaxseed oil, noted a relationship between flaxseed oil and sulphur-rich proteins (found in bee pollen, yoghurt, cottage cheese, oats, beans, meat, fish and eggs), and so recommended the two be taken together.[5,6] Oils and proteins are always found together in nature, so it would seem sensible to emulate that by taking oil supplements with a meal or snack that contains protein. We can also support and enhance fat digestion through using lecithin powders mixed into food or fresh smoothies or taking a digestive enzyme supplement that contains lipase, the fat digesting enzyme.

FISH OIL & DISEASES FEATURING CHRONIC INFLAMMATION

Chronic low grade inflammation is an underlying feature of many chronic diseases, including asthma, psoriasis and colitis, as well as rheumatoid arthritis, heart disease, Chronic Fatigue Syndrome (CFS) and cancer.[43] Zinc activated enzymes and certain types of prostaglandins made from omega 3 fats are just two of the body's natural anti-inflammatory defence pathways. Both will usually be deficient, and there will often be problems with absorbing and utilising these nutrients. It makes sense, therefore, to choose omega 3 fats that are in a form that is already converted to EPA and DHA, such as fish oil.

A review of the anti-inflammatory effect of omega 3 oils reports that EPA-rich fish oil down regulates the TH1 type response, which is associated with chronic inflammatory disease, as well as inhibiting the production of inflammatory prostaglandins. The report concludes that there is great potential for the use of fish oil in conditions such as asthma, and also for other chronic inflammatory diseases, in particular rheumatoid arthritis.[9]

Another study considered the potential anti-inflammatory benefits of fish oil in dealing with an even wider range of chronic inflammatory conditions, including rheumatoid arthritis, Crohn's disease, ulcerative colitis, psoriasis, lupus erythematosus, multiple sclerosis and migraine headaches. The review demonstrates that coronary heart disease, major depression, aging and cancer are characterised by an increased level of an proinflammatory substance called interleukin 1 (IL-1), and that arthritis, Crohn's disease, ulcerative colitis and lupus erythematosis are also characterised by a high level of IL-1, plus high levels of the proinflammatory leukotriene LTB(4). Both of these are produced by omega-6 fatty acids, while prostaglandins produced from the EPA in fish oils have been shown to counter this kind of inflammatory activity.[10]

FISH OIL & HEART DISEASE

The anti-inflammatory effects of EPA and DHA have been shown to have cardioprotective benefits[11], and in fact there is a wealth of studies that relate higher intakes of fish or fish oil with much lower incidences of heart disease. These studies show benefits with the full spectrum of heart-related condition, including arrhythmia, thrombosis, heart attack and stroke[12]. The EPA and DHA in fish oil seem to help keep blood vessel walls and heart tissue healthy and able to function well. Keeping levels of inflammation down helps prevent damage, and the blood thinning properties of fish oil helps to keep blood and the surrounding fluids flowing. This has a number of benefits, not least a healthy supply of nutrients, enzymes and hormones to keep our heart beating regularly and the blood vessels walls and heart tissue in top condition.

A major underlying cause of heart failure is thought to be scarring, or fibrosis, which builds up and prevents the heart from relaxing after each contraction. Fish oil has been shown to have a dramatic effect in reducing this scarring.[13]

The EPA and DHA content of fish oil also modulate sodium and calcium channels in every cell in the body, including the heart's muscle cells, where they help regulate the nerve impulses that trigger our heartbeat, and so keep it regular.[14] By regulating levels of sodium and calcium in each cell, fish oil will also have an influence on the pH, hydration, vitality and integrity of each cell, and so strongly effect how well all of our cells function, not just our heart cells.

DHA & VISION

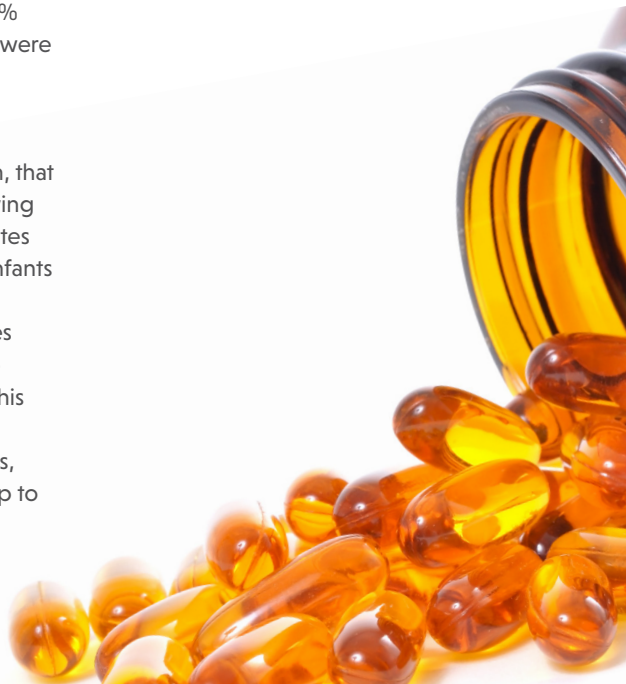
Several studies have linked omega 3 oils to healthy visual development, and also the maintenance of good eyesight. The Children's Hospital in Boston has shown how omega 3 oils can help prevent a major cause of blindness. Retinopathy is where the blood vessels in the retina at the back of the eye leak, and is responsible for blindness is millions of diabetics. The laboratory study showed an almost 50% decrease in retinopathy when fish oils were administered.[15]

In fact, the role of DHA in visual development has been so well proven, that EU legislation has endorsed the following claims: firstly, that DHA intake contributes to the normal visual development of infants up to 12 months of age; and secondly, that maternal intake of DHA contributes to the normal development of the eye of the foetus and breastfed infants.[16] This would support the promotion of DHA supplementation for pregnant mothers, breastfeeding mothers and children up to the age of 1.

FISH OILS & THE BRAIN: BEHAVIOUR AND ADHD

Perhaps the most attention given to fish oils has been for their ability to improve brain function and behaviour. In one episode of Robert Winston's "Child of Our Time", the BBC series that follows the development of 25 children born in 2000, two children with different behavioural problems were given daily fish oils. Within 3 months, one of them had gone from uncommunicative and withdrawn to outgoing and sociable, and the other had lost almost all signs of his previous aggression.

There is a wealth of studies that demonstrate the ability of fish oil to improve ADHD symptoms such as hyperactivity, cognitive problems, anxiousness and shyness,[17] as well as poor attention and impulsive behaviour.[18] Children with ADHD have also been shown to have lower levels of EPA and DHA in their blood, as well as lower levels of arachidonic acid, the long chain omega 6 oil that is also needed for the brain. The study of 53 boys that highlighted this concluded that this may not be just due to deficiency in the diet, but that it could also be due to an inability to convert the parent form of omega 3 into EPA and DHA, and the parent form of omega 6 into AA, the longer chain forms used by the brain.[19]



BRAIN FOOD FOR CHILDREN & BABIES

Trials with fish oil also noted an improvement in reading and spelling skills in children[20], demonstrating how EPA and DHA can help children as their brains are developing and learning new skills. Several trials have also highlighted the importance of essential fatty acids for babies, and show their levels of these crucial oils to be linked to the healthy development of their brains, nervous system, and also their visual development, as acknowledged by EU legislation. It was noted that breast-fed babies usually fared better in these areas, as breast milk is naturally rich in the range of essential fatty acids required, while formula milk is not.[21]

ALZHEIMER'S & PARKINSON'S DISEASE

Further studies with adults show a link with cognitive ability as we get older, too. A California study of 266 men and women aged between 67 and 100 found that those with a higher dietary intake of DHA were less likely to develop dementia.[22] Indeed the brain cells of people with neurodegenerative diseases such as Alzheimer's and Parkinson's disease feature a reduced level of DHA and other longer chain fatty acids.[23] Healthy brain cell membranes are usually particularly rich in DHA, EPA and arachidonic acid, which suggests that they play a vital role in how our brains and nervous systems function.

FISH OIL & AUTISM

Fish oil is a very popular supplement for children and adults on the autistic spectrum, and much has been written about its ability to benefit people with autism in a number of ways. An Egyptian study showed improvements in behaviour, concentration, motor skills and language.[24]

A published case study reported improvements in anxiety, agitation and quality of life in an 11 year old given up to 540mg EPA daily for 8 weeks.[25] It has been hypothesised that the issue lies in the ability to convert parent forms of essential fatty acids to the longer chain forms used most by the brain, such as DHA. Children with autism and Asperger's have in fact been shown to have lower levels of essential fatty acids, and also to have a higher omega 6 to omega 3 ratio.[26] A high omega 6:3 ratio is a feature of chronic inflammation, as we have already seen, and inflammation of the brain and other tissue is an area of much interest for research into autism.

An interesting feature of autism, Asperger's, ADHD and schizophrenia is an apparent sensory overload, which leads to extreme discomfort with sensations such as noise and touch. Most of us would filter out the majority of the sensations we receive from moment to moment, so as not to be overwhelmed by them. This is an adaptive process called sensorimotor gating, and studies have showed this to be impaired with people on the autistic spectrum or with schizophrenia.

A recent laboratory study found that DHA deficient mice also exhibited signs of sensory overload, or lack of sensorimotor gating. The scientists compared their startled reaction to a sudden loud noise, to how the mice reacted to the same noise when they were prepared for it by a softer warning sound. Usually the mice, and humans in the same situation, would flinch less when prepared for the noise, but DHA deficient mice flinched just the same as if they had been completely taken by surprise.[27] This suggests that DHA helps our nervous system to adapt to sensory input, and filter out much of the unhelpful information we receive through our senses.

SCHIZOPHRENIA & EPA

Childhood onset schizophrenia interestingly occurs most often at about the time that the frontal lobe of the brain goes through a stage of maturation that requires higher levels of essential fatty acids, a process called myelination.[28] Such teens have also been shown to have 4 times greater grey matter loss from their brains' frontal lobes than other children.[29] Adults with schizophrenia have disruptions to the oil profile of their cell membranes that would suggest that the ability to utilise essential fatty acids plays as big a role here as has been identified for dementia, Parkinson's disease and autism.[30] Unsurprisingly, then, EPA has been demonstrated to work well in improving the symptoms of schizophrenia.[31] In one trial in particular, almost half the patients taking EPA supplements were able to come off their antipsychotic medication.[32]

EPA AND DHA TOGETHER FOR DEPRESSION

A recent meta-analysis of 15 studies of people with depression has concluded that clear benefits can be found by taking either EPA or EPA and DHA together. "The findings are unambiguous," said Davis, Research Professor at the University of Illinois where the analysis was carried out. "Omega-3 fatty acids have antidepressant properties. Our analysis clarifies the precise type of omega-3 fatty acid that is effective for people with depression and explains why previous findings have been contradictory" Significantly, EPA and DHA are always found together in nature, including in fish oils.[33]

FISH OIL REDUCES THE IMPACT OF STRESS

Mental stress has been shown to significantly increase heart rate, mean blood pressure and energy expenditure. We can also measure its effects via our production of stress hormones epinephrine (adrenaline) and cortisol, both of which are raised in times of stress. One study gave healthy men fish oil supplements for 3 week to see if this made a difference to their stress mechanisms, and found very promising results. After just 3 weeks of supplementation, mental stress was found to have a significantly reduced effect on stress hormone production, energy expenditure and free fatty acid concentrations, which have been linked to diabetes and obesity.[34]

FISH OIL & CANCER

Many cancer patients seek out ways to bring more oxygen into the body. It has been pointed out, however, that there is often plenty of oxygen available to cancer of the blood, so perhaps the cell's ability to take up or utilise oxygen may be more of an issue. It may be that essential fatty acids such as those in fish oil can help with our oxygen uptake and utilisation. These unsaturated fats help keep the cell membranes more permeable, and their assistance with regulating sodium channels will have an effect on the cell's pH, which according to Warburg is important for oxygen levels: an acidic cell will be low in oxygen, where an alkaline cell will have more oxygen.

So on many levels fish oils would seem to be beneficial for cancer prevention. A

review of evidence for fish oil in relation to breast cancer, prostate cancer and other hormone-related cancers acknowledges that fish oil has been shown to inhibit proliferation of cancer cells in many laboratory studies. The same review points out, however, as do other reviews of cancer generally, that increasing dietary intake of fish and fish oil has inconsistent results outside of the laboratory. This supports our understanding that not everyone is able to fully utilise essential fatty acids, even when they are in EPA and DHA form: these oils still need to be absorbed and transported to where they need to be, and our bodies need to actively place them in the cell membrane (in phospholipid form). All of this relies upon certain conditions and supporting nutrients being in place.

We also know that working holisitically isn't about identifying one missing ingredient and then supplying it. It's about supporting the whole of the person, seeing the bigger picture of why that nutrient might be missing, and what other factors may be involved.

RANCID FATS & FREE RADICALS

EPA and DHA have a longer chain length in structure compared to ALA and have more double carbon bonds. Wherever there is a double carbon bond in the structure of an unsaturated fat, there is potential activity, an opportunity for a reaction, in the form of a negatively charged particle called an electron. We also know that the electrons at each kink in the structure of unsaturated fats make them highly reactive. They can be likened to children with lots of energy: give them something to play with and the result can be magical; shut them in a room full of ornaments with nothing to do and things may well get broken! This is when omega 3 and 6 fats can turn from health promoting oils to damaged fats through over exposure to heat or light, and in turn damage rather than help cell structure and pathways.

This is why it's important to protect all unsaturated fats, including fish oil, from air, heat and light during their manufacture and storage: they will react with the oxygen in air and become rancid, a process that speeds up in the presence of heat and light. If we use rancid oils, they will have lost their ability to support health. Good quality omega oils, either found in fish oil, krill oil of flaxseed oil, will stay fresh due to careful and minimal processing of the product.

QUALITY OF FISH OIL SOURCES

When looking for a fish oil supplement, it is therefore advisable to find out how mindfully the oil has been pressed, packaged and stored. Also look at the ingredients list to see if the oil is pure, or if it has been diluted with a cheaper oil.

In terms of food sources, oily fishes such as salmon, herring, sardines, tuna and mackerel are among the richest in EPA and DHA, but predatory fish from some parts of the world, including the Mediterranean, can be heavily contaminated with toxins such as methyl mercury.

High levels of methyl mercury has been linked to adverse effects on the brain, nervous system and heart. Its ability to cross both the blood-brain barrier and the placental barrier has heightened concern for developing foetuses. An episode of widespread methyl mercury poisoning in Japan in the 1950s resulted in at least 30 cases of cerebral palsy in children born to mothers contaminated during pregnancy. Further studies have shown a correlation between methyl mercury contamination in pregnant women and lower IQ in the babies born, as well as poor scores on a wide range of memory, attention, language, and visual-spatial perception tests.[41]

As a result of an independent survey, the Food Standards Agency now recommend that pregnant and breastfeeding women, as well as those planning to become pregnant, should limit their intake of tuna to no more than 1 fresh tuna steak or 2 medium sized cans per week. The same group of women and children under the age of 16 are also advised to avoid swordfish, marlin and shark altogether.[42] For similar reasons, it is advisable to ensure that any fish oil supplement you are taking has been tested for toxins such as mercury, lead and PCBs, which are a group of synthetic chemicals now widely banned that can have a detrimental effect on our hormonal and nervous systems.

HOW MUCH FISH OIL SHOULD I TAKE?

As with all supplements, once you have found a good source, it is advisable to start on a low dose and build up gradually. Between 1000-4000mg (1-4g) omega 3 oils daily for adults is often recommended depending on dietary intake. As with all supplements, once you have found a good source, it is advisable to start on a low dose and build up gradually splitting doses, over different meal times. Remember that protein helps fat absorption. Some may find that they can build up to this over a couple of weeks, some people may need longer. Children and babies need lower levels, depending on their size.

WHEN NOT TO TAKE FISH OIL

As fish oil is very effective for thinning the blood, it will perform a similar role to anticoagulant and anti-platelet medication such as aspirin, warfarin and heparin. If you are taking such medication, then fish oils should be avoided in order to avoid overthinning the blood.

HOW TO TAKE FISH OIL

Fish oil usually comes in capsule form, so that the capsule can protect the oil from going rancid. If you would prefer not to swallow the capsules, they are easily pierced, and then the contents can be squeezed into smoothies, juices or onto foods. This is a great way to get children to take fish oils, and also enables you to give just a drop of fish oil to babies.

We would also recommend that fish oils be taken with a meal or snack that contains some form of protein, such as fish, eggs, meat, nuts, peas and beans. Lipase, a fat digesting enzyme, and lecithin powder may also aid absorption of fish and other oils.

If you have any questions then please contact the Nutrigold team on 0800 233 5675 or email talk2us@nutrigold.co.uk

This education article was co-written by Dr Elisabeth Philipps PhD with Nutrigold.

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