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The Omega Wave

Fish oils are supposed to boost our brainpower. But do the facts really stack up? We went in search of the evidence.

Elliot Best with his mother Sheila.

Elliot Best is nine years old. A year ago, Elliot was falling behind in his schoolwork, particularly reading – which he found a struggle. He had little interest in studying and would crash on the sofa to watch TV when he got home from school.

But over the past year, a dramatic change has taken place in Elliot. He has soared through the Harry Potter books and now heads to the library after the school bell has sounded.

Elliot has been taking part in a scientific study on more than 100 children from 12 Durham schools. The children were required to take a course of capsules with their meals for the duration of six months.

"His reading jumped 18 months [over the trial period]. He's just a lot more interested in everything. He's even developed an interest in classical music," says Sheila, Elliot's mother.

Problems vanished

Over the course of the year, Elliot's academic problems disappeared.

Mark Hodgson, 10, who is in the year above Elliot at Timothy Hackworth School in Shildon, Durham, experienced similar changes.

"When I first heard about it, I didn't think Mark had any problems. He'd only been taking them a few weeks when I started to notice changes. His handwriting became better and his teachers said he was joining in more in class discussions," says Mark's mother Christine.

"At home, he started asking loads of questions. It was quite hard work for me."

The capsules given to children in the trial contained oils high in Omega 3 fats, which are found naturally in oily fish such as mackerel, salmon and sardines and in some plant crops such as rape seed.

Omega 3s and another group called Omega 6s belong to a family of fats known as essential fatty acids. The right balance of these two types of fatty acids is important for the healthy functioning of many parts of the body.

Heart of the matter

Omega 3 fatty acids are known to help prevent heart disease and they can improve the condition of some patients with depression and bipolar disorder. But their effects on brainpower have not been investigated in the same depth.

Can fish oils improve brainpower in some children?

The Durham trial was conducted by Dr Alex Richardson, a senior research fellow in physiology at Mansfield College, University of Oxford and Madeleine Portwood, a special educational psychologist for Durham Local Education Authority.

The results have not yet been published, but they are expected to show a statistically significant improvement in school performance in the group of children given Omega 3 supplements. This does not mean that every child benefitted from the treatment – many did not. But according to Portwood, about 40% of children showed some clear improvement.

In the dark

The children were selected on the basis that they were not fulfilling their potential at school, but their general ability was normal. They were subjected to regular tests to measure their co-ordination, concentration and academic ability.

The study followed an experimental method called a randomised double-blind controlled trial. Half the children were given capsules of Omega 3 fatty acids, and half given placebos. Neither the children nor those evaluating their progress knew which group was taking which treatment.

Richardson believes that conditions such as dyspraxia – characterised by poor physical co-ordination – dyslexia and attention deficit and hyperactivity disorder (ADHD) form a spectrum of associated conditions with some of the same underlying causes.

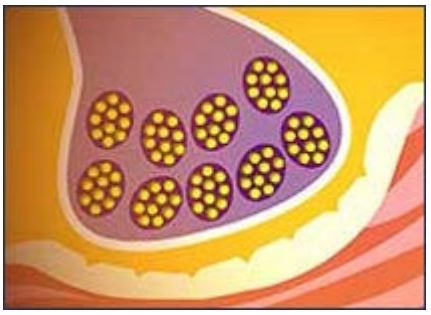
“Clinically, there is about 50% overlap between dyspraxia and dyslexia,” says Richardson, “and both show a similar overlap with ADHD.”

The dramatic effects of Omega 3 fatty acids on the children in the Durham trial may hinge on several functions of fatty acids in the brain.

Relay race

Electrical signals travelling through the brain get passed from one brain cell, or neuron, to the next – much like the baton handed between runners in a relay race. In the changeover, a signal needs to leave one brain cell at a point called the synapse and cross a physical gap before entering the neighbouring neuron.

For signals to enter a neuron, they need to pass through the walls that surround them. These walls, known as cell membranes, consist almost entirely of fats. About 20% are essential fatty acids like Omega 3s.



A synapse: Omega 3s may make it easier for signals to cross the gap between brain cells.

Embedded in brain cell membranes are structures called ion channels that open to allow the flow of electrical signals into the cell or close to prevent the flow. They perform this function by changing their shape.

One theory is that a specific Omega 3 fatty acid called Docosahexaenoic acid (DHA) makes the membrane that holds these channels more elastic, making it easier for ion channels to change shape.

If there is not enough DHA available, the membrane substitutes it with a molecule called DPA (n-6), which cells regard as the next best thing. This substitute is almost identical to DHA, but a tiny difference in the molecular structure of DPA (n-6) makes it vastly less flexible.

The substitution of DHA for a less flexible substitute may make it harder for ion channels to change shape within the fatty membrane, hindering their control over electrical impulses entering the cell.

No substitute

This substitution may also affect structures called G-proteins that sit on the inside of the cell membrane and are a vital link in the transmission of signals between brain cells. G-proteins help molecules on the outside of the membrane communicate with molecules on the inside.

The substitution of DHA for DPA (n-6) can cause a one thousand-fold reduction in the ability of G-proteins to perform this function, according to Dr Joseph Hibbeln of the National Institute of Alcohol Abuse and Alcoholism (NIAAA) in Bethesda, US.

This effect may be particularly important before birth; when connections are being created in the brain of the developing foetus. It is here in the womb that the replacement of DHA with its less supple alternative may have its most far-reaching effects.

“A good analogy is if you’re building a new [road network] and you don’t have the right type of concrete, you might choose an inferior substitute,” says Hibbeln.

“You might choose to make inadequate roads. But if you have the optimal fatty acid, it’s like having the optimal concrete – you make the right roads in the right places first time round.

“If you get the right type of concrete later, you can rip things up and re-lay the road, but it’s more expensive.”

> Omega 3s can improve brain function at the very simplest level, by improving blood flow - Dr Alex Richardson

Under pressure

But even if you’re prepared for the effort and expense, the benefits of repairing intrinsically flawed connections in the brain may be limited. The clearest indication of this came in 2001, in a study led by Dr Richard Weisinger of the University of Melbourne, Australia.

Weisinger’s team showed that laboratory rats deprived of essential fatty acids at specific stages in their development developed high blood pressure that remained elevated for the rest of their lives. The brain’s control over the autonomic nervous system and cardiovascular system was permanently affected.

However, studies such as the Durham trial suggest that all is not lost, and that boosting Omega 3 intake may still confer significant benefits.

The Omega 3 fatty acid used in the Durham trial was Eicosapentaenoic acid (EPA). It may play an equally crucial role in brain function. EPA is found only at very low levels in the cell membranes; it seems to have a functional, rather than a structural role.

“It can improve brain function at the very simplest level, by improving blood flow,” says Richardson.

EPA helps the body manufacture important, hormone-like substances called eicosanoids. Some of these substances help improve blood flow around the body. They also seem to have controlling effects on hormones and the immune system, both of which are known to affect brain function.

Western diets contain very little Omega 3 fatty acid. Hydrogenation, the process used to give foods a long shelf life, removes them. But certain people may break down Omega 3 fatty acids faster than others. Some of the children who showed greatest improvement in the Durham trial might fall into this category.

But there is disagreement over which Omega 3 fatty acid would perform best as a treatment. US researchers such as Hibbeln tend to favour DHA, while British researchers, of which Richardson is one, mostly regard EPA as the best option.

But some quarters of the medical research community are deeply sceptical about the usefulness of so-called complementary therapies - the category of treatment in which fish oil supplements are often lumped.

Professor Richard Olson, a developmental psychologist at the University of Colorado, Boulder and an expert on the treatment of dyslexia, urged caution over a 'quick fix' syndrome towards the treatment of learning disorders.

Stocking up: hydrogenation has helped drive Omega 3 fatty acids out of the western diet.

"I haven't read the research, but I have a slight feeling of unease because in the field of dyslexia particularly, one quick fix after another seems to pop up and then fall by the wayside," says Olson.

"I hope they're right. I'm just sceptical of easy answers because there have been various schemes in the past and parents [with dyslexic children] go out and spend a lot of money on them. For many children with dyslexia, improvement can only be achieved with a lot of hard work," he adds.

Clinical value?

Professor Maggie Snowling, a psychologist at the University of York also warned about the use of Omega 3s as a treatment for dyslexia.

"These studies tend to show statistically significant effects, but it's not clear if there are any clinical effects or real improvements for the children involved.

"[Omega 3s] are not a treatment for dyslexia. They might have some slight benefit on children with attention disorder, and some of them might have dyslexia. But there are a lot of provisos," says Snowling.

While researchers have yet to fully resolve how the balance of different Omega 3s affects brain function, one point on which they agree is that studies into their effects need to be widened beyond children.

"To my knowledge, there are no studies linking Omega 3s to improvements in cognition or neuropsychological function in otherwise healthy adults," says Hibbeln.

Does he think this is a promising area for future research? Hibbeln answers plainly: "Yes."