

Improving children's concentration and brain health

Guide for parents and teachers





Diet, nutrition and the brain

The brain is a bodily organ, just like the heart, liver, kidneys and lungs. As such, it needs a healthy environment to work properly.

That includes the whole range of essential nutrients – and the brain has even higher needs than the rest of the body for its development and tireless work in supporting cognition, memory, mood and behaviour.^{1,2}

Although it's only around 2.5% of the body's weight, the brain guzzles a quarter of the body's oxygen and blood supply at rest – and when it's active, like when reading or solving a puzzle, that jumps to half.

So, providing good nutrition is a critically important, but often overlooked, foundation for healthy learning in childhood.

Which nutrients?

Several different nutrients help deliver blood and oxygen to fuel neural activity, including the B vitamins and omega-3 fats

(which also do so much more, warranting a whole section on their own – see further below).¹

An array of different nutrients support the synthesis and activity of neurotransmitters – the brain’s communication system – among many other vital functions in the body and brain.

Zinc, for instance – found in shellfish, legumes, seeds, nuts, eggs, vegetables and wholegrains – is a jack-of-all-trades when it comes to good health.

As well as supporting immune function, growth, development and reproduction, zinc helps the developing brain and is an essential co-factor for more than 100 enzymes – hard-working proteins that catalyse virtually all chemical reactions in cells.

Iron is an essential mineral responsible for carrying oxygen to the body and brain – and it is the most common deficiency. Anaemia from iron deficiency affects up to a quarter of infants and many more suffer low levels without anaemia.

Insufficient iron has system-wide impacts and in relation to the brain has been associated with poor cognitive development and behaviour, including hyperactivity.

Iron-rich foods include fish, eggs, dried beans and lentils, green leafy vegetables, nuts and seeds – and contrary to popular belief, there is no evidence that vegetarians have lower iron levels than non-vegetarians.³

Iodine, found particularly in fish and seaweed, is so important for the developing brain that deficiency results in severe mental

retardation. Mild deficiencies are common in developed countries and have been associated with poorer cognitive function.⁴

Magnesium, rich in dark leafy greens and other vegetables, bananas and almonds, is another important mineral that is essential for every tissue and cell function in the body. It supports healthy immunity, is important for nerves, muscles and the heart, and helps brain development, memory and learning.

Low magnesium levels have been reported in children with attention deficit hyperactivity disorder (ADHD), and limited studies – one in conjunction with vitamin B6 – found less hyperactivity and sleep disturbance in children after magnesium supplementation.

Not to be forgotten, the thousands of polyphenols found in plant foods have antioxidant and anti-inflammatory properties – both of which are important for healthy brain function. In children, pine bark extract, a potent antioxidant, has lowered levels of hyperactivity and inattention in research trials.

Looking at multi-nutrient supplementation, a broad spectrum of high-dose nutrients was shown to improve attention, emotional regulation and aggression in children with ADHD.^{5,6}

An analysis of 15 clinical trials also found that multivitamin-mineral supplementation increased children’s IQ by 3.2 points overall in treatment groups compared to placebo.⁷

It must be noted that this was accounted for by children from poor neighbourhoods whose IQ increased by 8 points – nutrients are not a magic pill, they just correct any potential deficiencies.



Whole diet

Research has also linked whole diet to children's mental health⁸ and cognition and behaviour,⁹ but again, effects are not so consistent in children who are already well-nourished.

A study of 14-year-olds found that an unhealthy "Western" dietary pattern was associated with poorer cognitive performance three years later, at age 17.¹⁰

In younger children aged 3, an unhealthy diet – high in harmful fats, sugar and processed food – was linked to lower IQ at age 8, while a healthy diet was associated with higher IQ.¹¹

Effects can also be short-term – it's well-known that breakfast is an important meal, providing energy to help maintain attention and concentration.¹²

Clearly, it's hard to focus and stay calm on an empty stomach.

Breakfast quality is important though – sugary cereals will send glucose levels rocketing up and then plummeting down again.

High fibre, high protein breakfasts are best to support healthy brain function and sustain blood glucose levels.¹³

If children struggle to eat a substantial breakfast, research has shown that a nutritious mid-morning snack can make up for the resulting impact on concentration.¹⁴

Behavioural food reactions

Poor nutrition aside, certain foods can also promote hyperactive behaviour and interfere with children's concentration.

A grouped analysis of 15 placebo-controlled trials found that food additives increase hyperactive behaviour in hyperactive children.¹⁵

A landmark study in the UK then found that artificial food colourings and the preservative sodium benzoate caused hyperactivity in normal populations of school children (leading the government to ban those food additives).¹⁶

Some children can also react to other naturally occurring food chemicals

including amines, salicylates and glutamate as well as wheat or dairy foods.¹⁷

It's possible that altered gut bacteria might be impacting the digestive tract, so probiotics might be helpful to maintain a healthy gut.¹⁸

When food reactions are suspected, identifying offending foods is complex, involving a careful elimination diet which should be done under professional supervision.

However, eliminating highly processed foods with artificial additives is a good start for any child, hyperactive, inattentive, or not.¹⁹



Omega-3 fatty acids

When it comes to nutrients for child concentration and behaviour, omega-3s – found in oily fish such as salmon, tuna and mackerel, algae, dark leafy vegetables, nuts and seeds – are one of the best researched – and for good reason.²⁰

Science is now confirming that our ancestors were not wrong about fish being brain food.

The dry weight of the brain is made up of 60% fat – and the long-chain omega-3 docosahexaenoic acid (DHA) is more highly concentrated in the brain than anywhere else in the body.

Omega-6 fats are also important for brain function, although Western diets typically have too much of the unhealthy versions in processed foods, and it's important to keep these and omega-3s in balance.

Worryingly, studies have found that most children do not eat enough of the essential omega-3s,^{21,22} which must come from the diet because our bodies can't make them.

Overall, a 2017 review of European studies found that only a quarter of the population consumes the recommended daily intake of the two important long-chain fatty acids eicosapentaenoic acid (EPA) and DHA, and this was lower in children.²¹

It should be noted that although the body can make these omega-3s from the short chain versions found in plant foods, the best source is directly from fish or algae.

Much research has shown particularly low levels of omega-3 in children who have problems with inattention and hyperactivity, compared to healthy children.

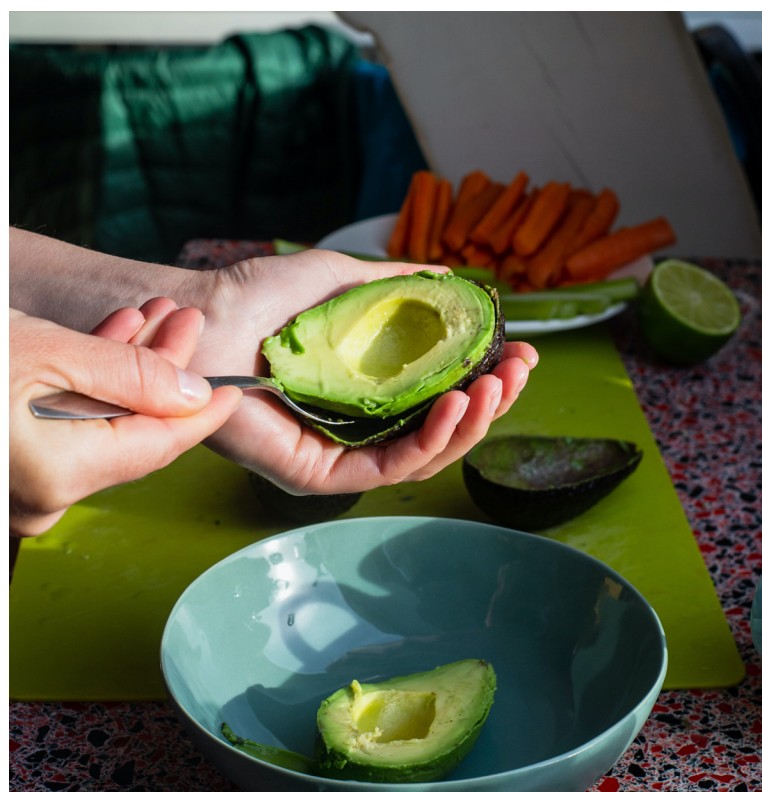
Importantly, a body of clinical trials has found improvements in attention, hyperactivity and impulsivity after supplementation compared with placebo.

In a 2005 placebo-controlled trial conducted in Durham, UK, with children who had dyspraxia (developmental coordination disorder), researchers found highly significant reductions in teacher ratings of cognition and behaviour, including hyperactivity, inattention and impulsivity, after fish oil supplementation.²³

Even more resounding improvements were found in reading and spelling.

On average, the children were about a year behind their age level at the start of the study. After three months, the children taking fish oil improved their reading levels by 9.5 months compared to the expected 3.3 months in the placebo group. Spelling improved by 6.6 months after fish oil compared to 1.2 months on placebo.

Another well-designed study, published in 2007, was conducted in Australian children with parent ratings of symptoms associated with ADHD.²⁴





They found significant improvements in hyperactivity, inattention and impulsivity following fish oil compared to placebo after four months of treatment, as well as improved ability to switch and control attention and vocabulary on cognitive tests.

A 2008 Swedish study supplemented children diagnosed with ADHD and, breaking the subgroups down, found the greatest improvements in children who had difficulties with attention, reading and writing.²⁵

Looking at the whole body of studies, it should be noted that results are mixed, with some grouped analyses showing small effects overall.

However, close inspection shows that study methodology is important to consider – including the length of the trial, the dosage, the selection criteria, outcome

measures, and whether or not the children were on medication.²⁰

Successful studies found improvements in children with at least 750mg of DHA plus EPA per day, given for at least three months. Improvements tend to appear, and increase, over time – the Australian trial found that improved attention and hyperactivity were still increasing after six months on fish oil.

And although these studies have had positive outcomes on average,²⁶ some children respond better than others – possibly those who had low omega-3 levels to start with.

It's also possible that they need more than omega-3 – not only other nutrients but also other support to concentrate and control their behaviour.

Other tips for parents and teachers

The ability to concentrate, focus attention and control emotions and impulses are higher order “executive” brain functions that develop gradually throughout childhood and adolescence.

Once nutritional foundations are addressed, children benefit greatly from our support in helping them to develop these skills.



Physical activity

Being physically active has multiple benefits at any age – and one of those for children is helping them to concentrate, confirming the importance of running around at recess or letting off some steam before doing homework.^{27,28}

On the other hand, sitting and being inactive for too long has been linked to poorer attention, memory and learning.²⁸

One reason for this is because physical activity helps to get the blood moving and send hormones, glucose and oxygen to the brain.

It also helps develop new brain cells and neural connections from an early age.

In one study, students had better attention and performance outcomes on an academic test after just 20 minutes of walking.

Students with physical education classes at school have also had higher numeracy and literacy scores.²⁹

Ways to get children moving include making physical activity part of the school curriculum, taking active breaks in the classroom, access to equipment and spaces to move during recess, active transport (walking, riding) to and from school, and after school sports activities.

Nature, stillness, mindfulness

Green environments can have multiple benefits for cognition and wellbeing, and one study found that children who walked in nature – a city park – did better than those who walked in more urban environments³⁰.

The stillness offered by nature could play a role in this, as mindfulness – gently bringing the focus to the present moment – has been associated with better concentration as well as relieving stress and increasing happiness^{31,32}.

Mindfulness doesn't come naturally, especially in today's busy world teeming with distractions, so parents and teachers can help children practice mindfulness meditation – even a few minutes a day can bring profound rewards.





Limit screen time

Increasing research points to the impacts of excess screen time – such as computers, tablets and television – on children’s brains, in turn affecting their memory, attention and language development.³³

A recent study showed it can also affect their communication skills, problem solving ability and social interactions over time.

Experts recommend limiting screen time and developing healthy habits like watching quality shows and engaging with children to make it more interactive, by talking about what they’re watching and highlighting points of interest.



Make it fun

We all focus and learn better when we’re interested in the topic, so it can make a big difference if the learning material is related to something that excites children,³⁴ or is presented in a stimulating, interactive form.

Jigsaw puzzles, crosswords and other stimulating activities can also help develop concentration and focus.³⁵



Study habits and sleep

Some other strategies include encouraging children to focus on one thing at a time, breaking tasks down into smaller, doable chunks, helping them organise their notes and study space and learn how to deal with distractions.³⁶

This could include taking a short break when they have trouble focussing or taking a few deep breaths to refocus.

Regular routines and bedtimes, with plenty of sleep, are also vital.³⁷

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Natalie Parletta



Natalie Parletta (formerly Sinn) is an adjunct Senior Research Fellow, nutritionist and freelance science writer. She has a PhD, Bachelor of Psychology (first class Honours) and a Master of Dietetics. For more than 10 years she researched links between nutrition and mental health, parental influences on child and adolescent diets and benefits of the Mediterranean diet for heart and mental health. She has published 60 peer-reviewed papers with more than 3,000 citations and won several awards including a SA Science Excellence Award, 2012, and a SA Health Award, 2013.

Natalie's PhD investigated effects of micronutrients and omega-3s on learning and behaviour in children with ADHD. She continued this work with an ARC Fellowship and PhD student Catherine Milte, investigating omega-3 benefits for children with ADHD and learning difficulties, and cognition, mood and quality of life in elderly people with mild cognitive impairment. She extended it further with an ARC-Linkage grant to investigate learning and behavioural benefits of omega-3s for Indigenous children living in remote communities.

Natalie then developed a program (HELFIMED) for including Mediterranean-style diets into rehabilitation programs with people who have mental illness, in collaboration with Outer South Mental Health, Southern Adelaide Local Health Network. With postdoctoral research fellow Dorota Zarnowiecki, her team adapted the program in one of the world's first randomised controlled trials for people suffering depression (now published). She has given more than 100 talks, including 40 as invited speaker, nationally and internationally, more than 100 media interviews, and now writes public articles on nutrition, psychology and science more broadly.

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