
**Article written by Eleanore Widger MA in consultation with Elaine Brown T2TUK/Kagan-UK**

## Nutrition for Learning

The principal behind nutrition for learning is that substances found in the foods pupils consume have a direct effect on their behaviour and ability to learn. These substances cause the brain to produce certain chemicals which can result in negative outward manifestations such as anxiety, sleepiness, and the inability to concentrate, or positive ones like alertness, creativity and calmness. By applying this knowledge to lesson content and structure, teachers can help establish healthy eating habits in their students so that time spent in the classroom is as fruitful and enjoyable as possible for everyone. Ensuring children consume those nutrients which contribute to optimum brain function can help knowledge be learned more easily, remembered more effectively and retrieved more quickly, and help learners avoid unhelpful behaviours.

### How nutrition helps the prepare the brain for learning

According to Marcus Conyers, whose interdisciplinary programme, BrainSMART, uses neuroscience to inform teaching theory, learning changes the physical structure of the brain. New knowledge, he claims, is acquired when a student thinks about a problem, or experiences a new sensation, for example, causing the creation of a new pathway between neurones. Knowledge about how to solve that problem, or the meaning of that sensation, is then embedded permanently in the brain of the child. This process can take place an unlimited number of times. It happens most easily and effectively when the child is exposed to multiple stimuli. For teachers, he says, this means that varied lessons are the best way encourage the creation of new pathways through mental stimulation, and help learners perform at peak levels.

But a high level of mental performance must also be supported by the healthy functioning of neurones. Neuroscientists and nutritionists agree that the absorption of the appropriate nutrients can ensure that neurones are in good condition and are functioning properly, and therefore aid the establishment of new connections and the production lasting knowledge. In other words, nutrition helps condition the brain so it is optimally receptive to learning.

This is a concept many parents will know by instinct, and of which teachers will have plenty of anecdotal evidence, and is also corroborated by extensive research. Teacher, nutritionist and academic Sandy Baumann's approach is also based on the idea that healthy neurological connections make it easier for the brain to learn and retrieve information effectively. She claims that by adjusting children's diets so that they consume the appropriate combinations of nutrients helps prepare their

brains to make more and stronger connections, so that they attain the highest level of academic success possible for them individually.

According to Baumann, in order for the brain to work efficiently, the building blocks for neurotransmitters to send messages between the brain and the body must be in good condition. For this, the brain needs the right supplies of the following key things: water, to carry electrical impulses; iron, to carry oxygen to the brain; oxygen and good circulation to provide nutrients to the brain; and glucose in steady amounts to use as fuel. It is not therefore unreasonable to conclude that a healthy diet and exercise will ensure these optimum conditions are met in the brains of school learners.

In addition, she claims that lethargy, inattentiveness and behavioural problems such as hyperactivity, can be reduced by ensuring children get the right nutrients. This is because certain foods encourage the production of various chemicals and hormones in the body, such as serotonin, melatonin, cortisol and dopamine, whose effects can manifest negatively in mood, behaviour and ability to learn.

## Evidence for the importance of nutrition for brain function

All the nutritionists consulted for this article stress the importance of vitamins, iron, protein, glucose, oxygen and water for healthy brain function. Eric Jensen, author of *Brain-Based Leaning*, claims that 'alertness, memory, visuo-spatial ability, attention and planning/organisational skills are directly impacted by critical vitamins (such as vitamins A, C, E, and most of the Bs, as well as folic acid, lecithin, magnesium, sodium, potassium, zinc, iron, boron, and selenium)' (77). If teachers observe these capacities to be limited in their classroom, one explanation could be that many learners are deficient in these vitamins, and might consider, Jenson suggests, recommending or providing a vitamin supplement to students. But this is of course not always possible, and should not be a substitute for a diet rich in fruit and vegetables of all colours, particularly, according to Baumann, lots of leafy greens, which is the best way to ensure these vitamins are available to the body. Once the right levels of these nutrients are achieved, learners have the potential to increase the key skills and capacities Jensen identifies above.

Hydration, both Baumann and Jensen agree, is vital to the preparation of the brain for learning. He writes, 'as with all animals, we have a "consummatory" prowling behaviour that emerges when water is absent or restricted. This behaviour increases our stress hormones (cortisol) and increases responses to novelty (overreactions). But within five minutes of consuming water, there is a marked drop in stress hormones and our behaviours become more predictable' (76). In other words, being thirsty can cause reactions in the brain, and in turn outward behaviours, which preclude learning, even whilst those behaviours might not be identified as being caused by something as simply resolved as thirst. By ensuring pupils are hydrated, then, teachers can reduce symptoms like overreaction to novelty,

which might manifest as the inability to focus on a task, fidgetiness, or talkativeness etc. In practical terms, this might mean that teachers have to provide, or allow, water-bottles in class.

Eating good sources of protein can help put the brain on what Baumann calls, 'Cruise Control' (30). By this she means that protein, found in foods such as milk, meat, poultry, fish, nuts and eggs, slows down the bloodstream's absorption of sugars, allowing a more consistent, longer-lasting release of energy, and consequently a more sustained ability to concentrate. By combining them with proteins, the body is able to make the most out of the glucose and energy provided by carbohydrates, instead of experiencing a cycle of sugar highs and lows.

Proteins also have other properties that can be harnessed in order to aid learning. They contain tyrosine, which the brain uses to make the neurotransmitters, or chemical messengers, dopamine and norepinephrine, and which help the brain remain alert. On the other hand, they also contain tryptophan, which has a calming effect on the brain, and could therefore be used to help learners with hyperactivity concentrate more easily, or as part of an evening meal to aid restful, restorative sleep.

Crucial after a good night's sleep, these experts unanimously agree, is a good breakfast. Hunger impairs cognitive function; missing breakfast impairs performance of short-term memory exercises, general mood deteriorates and stress increases (Jukes et al 81). Baumann cites a study conducted by teacher Pamela Green on the effects of a balanced, high protein, low carbohydrate breakfast on absence, time spent on task, class disruption and assignment completion, noting the positive effects in all areas and anecdotally proving the efficacy of a balanced breakfast on ability to learn effectively (63-70).

## Evidence for the negative effects of poor nutrition

Not only does research suggest that good nutrition helps make learning more effective, but that poor nutrition actually hinders cognitive function, and therefore the efficacy of teaching. The Committee on Nutrition Standards for Foods in Schools (CNSFS) found that 'inadequate nutrition [...] may adversely affect the ability to function at peak mental and physical ability' (30). Among the problems that may be caused by poor nutrition, and of which teachers will have experience, these experts list insomnia, difficulty concentrating, anxiety, depression, and a tendency towards violence etc. For example, the CNSFS found that 'iron deficiency has been linked to poorer cognition and behavioural and learning problems among school-age children and adolescents,' citing a study that found iron-deficient children achieved lower test scores than children without iron-deficiency (36). Note that iron deficiency can be caused by not consuming enough iron-rich foods (red meat, broccoli, apricots, for example), or by not consuming enough of those vitamins which help the body absorb iron from food (in particular vitamin C from tomatoes, oranges, kiwis etc.).

Simple carbohydrates can have extremely adverse affects in the classroom. Snacks like cakes, muffins, chocolate, biscuits and crisps, which many children will bring to school with them out of convenience and affordability can cause them to disengage with lessons late in the morning and afternoon due to a slump in their blood sugar and energy levels. This is a particular problem considering the use of processed and high-fructose sweeteners in much of the food available to and marketed towards children. Baumann explains how 'carbohydrate in highly refined, high-sugar products is quickly converted into glucose, which moves rapidly into the bloodstream, producing high blood sugar [...] the pancreas releases a lot of insulin in response' (28). This cycle therefore not only results in alternate bursts of high energy and lethargy but can have more serious long-term consequences such as Type 2 Diabetes. One solution, recommended by Baumann, might be to encourage learners to snack on more complex carbohydrates combined with a source of protein, as discussed above, such as whole-grain toast with peanut butter, fruit topped with yogurt, or a handful of nuts and seeds.

In her book, *Healthy Kids*, Marilu Henner claims, 'as with sugar, many experts believe that large doses of caffeine can cause children to behave as though they have hyperactive disorders,' (50). The 'buzz' effect that motivates adults to drink caffeine, but which can prevent school-age learners from engaging in class could actually be an increase in adrenaline and stress hormones.

Caffeine, alcohol and nicotine obstruct the absorption of vitamins and nutrients (Jensen 80). Caffeine's diuretic effect not only depletes the body's supply of water, but flushes out its supply of water-soluble vitamins B and C. Therefore, if children consume high volumes of fizzy drinks or takeaway coffees, for example, they might still exhibit some of the behaviours caused by inadequate nutrient absorption even if they eat well. Like-wise, older school learners who smoke or regularly binge-drink might also experience reduced cognitive function. Both Jensen and Baumann recommend that whilst the content of lessons might combat this by focussing on making healthy choices, lessons could also be structured so that there is time built in for water and snack breaks.

It is important to emphasise here that substances like simple sugars and caffeine don't simply provide no benefit to learning, but actually hinder it, by causing stress and low mood, preventing proper nutrient absorption from food to the blood, and also preventing the successful disposal of any water-soluble nutrients that may have been absorbed. Whilst it is admittedly very challenging to influence the eating habits of school-age pupils outside the classroom context, one achievable aim might be to educate about the problems associated with caffeine and fizzy drinks, and make the classroom, or indeed the whole school, a fizzy drink and coffee-free zone.

<u>Limitations of nutrition/impact of other factors such as background</u>

Whilst the benefits of nutrition for learning are substantiated by anecdotal and academic evidence, socioeconomic factors, for example, can complicate its efficacy. Jensen highlights the fact that children from low income backgrounds are less likely to consume the right amounts of vitamins and protein, often consuming less expensive carbohydrates instead, and therefore achieving lower academic standards (78). Even where protein is present in the diet, those children who do not consume enough calories simply do not have the glucose levels to fuel successful brain functions, and are therefore also more likely to exhibit faulty memory, increased error rates, clumsiness, panic, anxiety and hostility. Indeed, as Matthew Jukes explains, in *School Health, Nutrition and Education for All: Levelling the Playing Field*, 'as children enter school they may already be suffering from the cognitive disadvantages of growing up with health and nutrition problems. That is, even children who are currently in good health may lag behind peers in school work because they were ill or nutritionally compromised in infancy or the pre-school years at important times for cognitive or social development' (80). This means that improving the present nutritional and lifestyle choices of school learners might not necessarily improve their academic performance, and that other economic and school structures might first need improvement or amendment before the most effective learning experience can be provided for children of all backgrounds.

The implementation of well-planned lessons is evidently crucial in making the most of good nutrition. Jukes cites a study that showed how eating breakfast in well-organised classrooms helped concentration, whereas in poorly organised schools the reverse happened, because food was found to energise behaviour, whether good or bad (79). This means not only that children benefit from the parallel improvement in nutrition and lesson quality, but that the deployment of properly structured lessons in conjunction with a healthy breakfast is the best platform from which to learn. Consequently, it is worth bearing in mind that if children have had breakfast it might actually hinder their learning where organisation is lacking in the lesson plan.

How does nutrition for learning fit in with Kagan Cooperative Learning teaching methods.

Adopting a range of instructional strategies encourages increased neurone stimulation, and ensures that all types of learners receive instruction in the way that suits them best (Conyers, BrainSMART).

Kagan Cooperative Learning Structures provide just that – a range of instructional strategies.

They are a content free repeatable set of steps that organises the interaction of the student with each other, the teacher and the curriculum. They have been devised and designed with the brain in mind.

Brains function well only if there is an ample supply of oxygen and glucose. The brain is dependent on a constant flow of nutrients. A healthy diet provides the nutrients, movement increase the supply of these nutrients to the brain. Cooperative Learning structures encourage movement so brains are better nourished, more alert and more receptive to learning

## Conclusion

I have consulted only a small sample of the ready literature on the subject of nutrition for learning. The extent of comment on investigation into the issue – scholarly articles, scientific research, educational theory and even YouTube videos – show that it deserves serious consideration by all those involved in teaching. However, caution should be exercised when assuming that understanding brain function will help combat behavioural issues, as cognitive function and the way in which a child might behave in the classroom constitute different levels of analysis. But using neuroscience to inform educational practice might help school learners achieve higher levels of academic success.

Jukes identifies three key motivations for pursuing this approach: 'improving children's health and nutrition brings substantial benefits for cognitive development and education; improving health and nutrition brings the greatest educational benefits to the poor and most vulnerable; and health and education reinforce one another' (81). In other words, nutrition education is most effective when delivered in the context of a whole school approach. Schools could consider not only educating about but providing breakfast, water, and opportunities for exercise. Lessons on nutrition could, for example, coincide with practical experiments conducted on and by students themselves, involving their commitment, even if temporarily, to a healthier diet designed to aid concentration and provide a constant supply of energy.

Perhaps the most simple, practicable advice teachers might draw from this research is – even if they can do nothing else – to encourage pupils to cut out caffeine and eat breakfast wherever possible. In so doing teachers might reduce the major barriers to learning already present before pupils even reach the classroom, and start to observe how nutrition can be harnessed to help manage the behaviour of students, and ensure their brains learn in the most effective and lasting way they can.

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