

Vitamin Food for Thought

a **DSM** Product



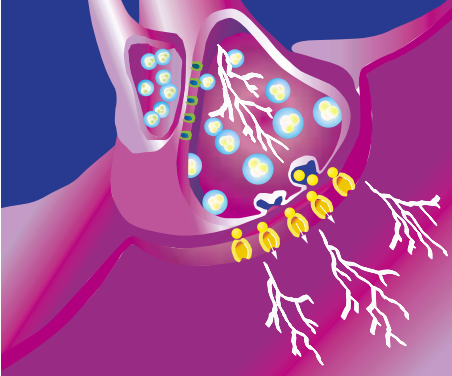
DSM Nutritional Products

Unlimited. **DSM**

Look after your brain by:

- Eating a nutritious, balanced diet
- Taking vitamin supplements to avoid a shortfall in essential micronutrients
- Regular exercise, both mental and physical





**Chemical messages
pass across brain
synapses**

The miracle of the mind

The brain is arguably the most important organ in the human body. It is the centrepiece of the nervous system that regulates all the functions of the body which we take for granted such as the beating of the heart or the regulation of our body temperature. These are things that the brain controls without any need on our part for conscious effort. This leaves us free to use our brain for other important activities, notably communication and learning, which are the vital ingredients for our social development. Our brains also allow us to enjoy life – whether in the creation of artistic masterpieces, great sporting achievements or simply reading a morning paper, the brain is the key to all.

It is easy to overlook that the brain, like any other organ, needs to be maintained in a healthy state for optimal performance. Brain Health is not just the «Luck of the draw» – to a large extent good brain health is under your control. Here we give an overview of the working of the brain from early development through to later life. At each step we examine how we can help maintain a healthy brain by ensuring a certain nutritional profile.

Nutrition and the brain

How does the brain work?

The brain is a phenomenally complicated organ and no-one fully understands how it functions. We do know that the brain consists of countless interconnecting brain cells. These communicate with one another via connections known as [synapses](#) using specialised chemical messages known as [neurotransmitters](#). Signals travelling across these connections in a myriad of combinations make up the information processing activity of the brain.



Brain development in early life

The importance of nutrition during pregnancy...

During pregnancy, the infant relies entirely on the mother's supply of the essential long-chain fatty acids DHA (docosahexaenoic acid) and AA (arachidonic acid). A low intake or a shortage of these long-chain fatty acids during pregnancy and lactation can lead to delayed visual acuity and delayed neurological development of the infant.

The connections between brain cells begin forming very early in development, before birth. The last trimester of pregnancy is the most critical period of brain growth and neurological development. At this time, the omega-3 and omega-6 long-chain polyunsaturated fatty acids DHA and AA accumulate in the brain. These fatty acids have structural roles in cell membranes and play a vital role in the transfer and release of neurotransmitters and hormones across synapses.

Nutrients for babies....

New born babies continue to need DHA and AA, and can obtain them from their mother's milk.

Once a baby is born the brain continues to develop and the connections made between brain cells early in life are the basis of the learning and development processes.

Accumulation of DHA and AA continues until the end of the first year of life and breast fed children obtain their supply of these fatty acids via the mother's milk.

Breast milk contains a host of other bioactive compounds that are essential for neurological development. Among these are amino acids such as taurine, as well as choline (a precursor of the neurotransmitter acetyl choline), and nucleotides.



Neurological development in infants: The importance of vitamin B₆...

Infants showing marginal vitamin B₆ deficiency can have a lower birth weight and may develop neurological and behavioural problems.

Vitamin B₆ is an important coenzyme in the biosynthesis of neurotransmitters such as ABA (gamma amino butyric acid), dopamine and serotonin. Vitamin B₆ is important both during pregnancy and lactation. Mothers with inadequate B₆ often give birth to smaller babies. During lactation these babies tend to be more irritable and cry more at night.

Essential nutrients for mother and baby...

Pregnancy imposes a heavy strain on the mother.

In this critical period, essential nutrients are needed for foetal growth, growth of the placenta and expansion of blood volume. It is therefore important that the pregnant mother gets all the essential nutrients a healthy baby needs.

The most critical nutrients during pregnancy are the vitamins A, D, E, vitamin B₁, B₂, B₆, niacin, folate, vitamin B₁₂, iron, calcium and the long-chain polyunsaturated fatty acids DHA and AA. If daily requirements of these nutrients cannot be met by dietary means alone it is safe to take a well balanced dietary supplement to safeguard against possible nutritional inadequacies of the mother and her developing infant.

Adequate fortification of infant formula and infant foods with all known essential micro-nutrients including vitamins, minerals, trace elements and long chain polyunsaturated fatty acids is essential to support neurological development. DHA, AA, taurine, choline, nucleotides and the carotenoid lutein should also be considered for inclusion. Several authorities have made recommendations to include these nutrients in infant formula.



Mental performance in school children and students...

School children and students lacking dietary essentials may not reach their full mental and cognitive potential and the benefit of micronutrient supplementation on mental performance has been confirmed in adults.

A number of studies have shown that improved nutritional support enhances mental performance and learning capacity. Furthermore, inadequate nutrition can adversely affect learning ability and concentration. The importance of a healthy, nutritious breakfast for brain performance is also increasingly being recognised. Similarly, providing healthy, nutritious food in schools by means of school lunch programs is an important public health measure to enhance learning and well-being of students.

Micronutrients for learning...

A fortified breakfast may help ensure that adequate micronutrients are taken in for optimal mental performance. If the levels of these micronutrients are not always met by dietary intake alone, a nutritional supplement can help make up the difference.

The micronutrients likely to play an important role in brain performance include vitamins of the B-complex, vitamin C, iron and zinc. Vitamins of the B-complex, mainly vitamin B₁, B₂, B₆ and niacin are needed for synthesis of neurotransmitters.



Nutrition for the brain throughout life

«You are what you eat...»

The type of nutrients taken with a single meal can affect mood, behaviour and even symptoms of depression.

There is a popular saying «You are what you eat». Research suggests that there may be more to it than just a saying. Nutrition can influence mood, behaviour and depression. Compounds such as amino acids are direct precursors of neurotransmitters and hormones which regulate brain physiology and function.

The amino acid [tryptophan](#) for example is a precursor of [serotonin](#), an important factor in mental well-being. [Choline](#) is a precursor of acetylcholine, and important neurotransmitter. Studies have shown that enhanced intake of these amino acids can modulate mood and behaviour.





The importance of folic acid and vitamin B₁₂ in later life...

Folic acid and vitamin B₁₂ have been shown to improve mood and reduce symptoms of depression in the elderly.

In later life, low intake and low blood levels of folic acid and vitamin B₁₂ have been associated with depression and poor mood. Mental disorders may be aggravated by low B-vitamin status and folic acid supplementation has been shown to improve mood and reduce symptoms of depression. As deficiencies of folic acid, vitamin B₁₂ and vitamin B₆ are frequently found in the elderly, supplementation with these vitamins is recommended.

Combating mental decline...

Adequate intake of vitamins C and E and carotenoids has been shown to retard the cognitive decline associated with ageing.

Epidemiological results suggest that adequate intake of dietary antioxidants may guard against loss of memory and brain function. People with optimal intakes of vitamins C and E, as well as carotenoids are better protected against cognitive decline and early appearance of dementia. Vitamins C and E may act synergistically to thwart free radicals which have been implicated in damage of neurones and brain structures.

The problem of homocysteine...

High levels of homocysteine – a marker of vascular health – have also been associated with cognitive impairment in later life.

A significant number of elderly people have mild to moderate age-associated memory impairment. As a result of metabolic problems, homocysteine accumulates in the blood and



vascular tissues and this may aggravate loss of mental ability. Studies in humans have shown that homocysteine levels can be reduced markedly by folic acid, vitamin B₆ and vitamin B₁₂ supplementation. These vitamins are involved in the degradation of homocysteine to metabolites which are excreted. Hence, vitamin B-supplementation may retard age-associated cognitive impairment.

Vitamin E in Alzheimer's and Parkinson's diseases...

A large study in Alzheimer patients has shown that vitamin E supplementation over a period of two years has a modest benefit in retarding progression of the disease.

Free radicals (highly reactive molecules) are implicated in the pathology of neurodegenerative diseases such as Alzheimer's and Parkinson's diseases. Because more people than ever reach old age the incidence of such degenerative diseases of the brain and nervous system is increasing. Although the underlying causes of Alzheimer's and Parkinson's disease are not yet fully understood, biochemical studies indicate that free radicals are involved in the loss of neurones and brain cells. Excessive accumulation of free radicals can lead to a loss of neurones and progressive dementia.

Supplementation for the brain in later life:

A good, balanced diet can help ensure optimal intake of nutrients important for brain health later in life. If maintaining such a diet is difficult, a nutritional supplement can be beneficial.

The micronutrients likely to guard against a decline in brain performance include dietary antioxidants (mainly vitamin C, E and carotenoids) as well as folic acid and B group vitamins.

Nutritional profile for brain development and performance

Nutrient/ Vitamin	Main function	Suggested daily dose (according to recent science)
C	Antioxidant, regenerates Vitamin E	60 – 500 mg
A	Visual pigment, cell differentiation and growth	400 – 800 mcg
D	Calcium absorption and metabolism	5 – 10 mcg
E	Antioxidant in membranes and tissues	10 – 300 mg
B ₁	Coenzymes for energy release and neurotransmitter synthesis	1.2 – 1.4 mg
B ₂	Coenzymes for energy release and neurotransmitter synthesis	1.3 – 1.6 mg
B ₆	Coenzymes for energy release and neurotransmitter synthesis	1.3 – 2.0 mg
Niacin	Coenzymes for energy release and neurotransmitter synthesis	16 – 18 mg
Folic acid	Coenzymes for energy release and neurotransmitter synthesis	200 – 400 mcg
B ₁₂	Coenzymes for energy release and neurotransmitter synthesis	1 – 3 mcg
Pantothenate	Coenzymes for energy release and neurotransmitter synthesis	6.0 mg
Biotin	Coenzymes for energy release and neurotransmitter synthesis	150 mcg
Beta-carotene	Quenches of singlet oxygen	1 – 6 mg
Lutein	Quenches of singlet oxygen	1 – 5 mg
Zeaxanthin	Quenches of singlet oxygen	1 mg
Omega-3 (DHA)	Main fatty acid in synaptic vesicles	200 – 500 mg
Choline	Precursor of acetyl choline	275 mg
Taurine	Development of retina, fat digestion	5 – 12 mg/100 kcal*
Nucleotides	Precursors of nucleic acids (DNA, RNA)	10 – 16 mg/100 kcal*
Calcium	Signal transfer	400 – 800 mg
Magnesium	Signal transfer	200 – 350 mg
Iron	Energy (electron), transfer in cytochromes	10 – 18 mg
Zinc	Gene expression, enzyme cofactor	10 – 15 mg
Selenium	Antioxidant (glutathione peroxidase)	30 – 55 mcg

* content in mature human milk

The above list cannot be considered to be exhaustive. In addition to the micronutrients listed here, a number of other compounds could be considered for a role in brain health.

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Interested in this Vitality Concept?

Contact us for more information and project support!

- In growing infants micronutrients such as long-chain polyunsaturated fatty acids, taurine (an amino acid) and choline (a precursor of the neurotransmitter acetyl choline) are essential for development of the brain and nervous system.
- Learning ability in school children and students can be improved by optimal levels of B-complex vitamins, vitamin C, iron and zinc.
- Micronutrients supplied in a single meal can affect mental performance, mood and behaviour.
- Dietary antioxidants (mainly vitamin C, E and carotenoids) can help slow down the cognitive decline associated with ageing.
- Elevated levels of plasma homocysteine are associated with age-related cognitive impairment as well as being a new marker for vascular health. Blood levels of homocysteine are reduced by B-vitamin supplementation.
- Vitamin E supplementation may delay the progression of neurological diseases such as Alzheimer's and Parkinson's diseases.

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