

NUTRITION FOR THE BRAIN

Much interest has recently been focused on brain nutrition. From the last trimester of pregnancy, through the developmental stages of life to adulthood, important nutritional elements are currently being researched. The findings from this research have revealed a number of important nutrients that are key to brain development and function. Clinical manifestations of deficiency syndromes are also being investigated. Many of these research projects emphasize the role of polyunsaturated fatty acids in brain development and nutrition. The importance of many of these nutrients in the development and maintenance of the brain have previously been underestimated.



The role of DHA (docosahexaenoic acid) and AA (arachidonic acid)

Today it is accepted that DHA and AA are key fatty acids for the brain. These essential fatty acids should be given in their active forms, and not as early precursor molecules (alpha-linolenic acid (n-3) and linoleic acid (n-6)), to secure optimal development of the neural, visual and cognitive functions.



DHA and AA constitute the most abundant brain lipids; deficiencies adversely effect both visual acuity and the brain's perceptual and cognitive functions. Animal experiments show that the two fatty acids should be properly balanced to secure the development of both visual function and attention, without slowing somatic growth.

DHA and AA are important fatty acids used for regulating the fluidity in cellular membranes. High levels of these fatty acids give a fluidity to membranes necessary for rapid movements of membrane proteins and the membrane itself. Rapid membrane movements is important during processes such as light stimulation of the rods and cones in the eye and for the transmission of electric impulses throughout the brain - in particular synaptic transmission of nerve signals.

As a further inducement for the supplementation of DHA, AA and GLA, one will find that these are all abundant in breast milk including the precursor molecule of AA, which is called gamma-linolenic acid (GLA) (n-6). AA is an active fatty acid that is the precursor of whole families of biologically active molecules (prostaglandines, prostacyclines, thromboxanes and leukotrienes) involved in several biological processes. One should therefore be cautious when supplementing their diet with AA. Our brain nutrition capsules contain an optimal and safe mixture of these three fatty acids (DHA, GLA and AA).

The concern of lipid peroxidation in the brain

Since so much of the brain tissue consists of fatty acids, which are easily peroxidized, the brain needs an excess of protective antioxidants. One of the greatest concerns in fatty acid supplementation is that they are easily destroyed by oxidants and may form toxic substances. Therefore, the presence of antioxidants is crucial for brain function

and optimal utilization and preservation of the long chained polyunsaturated fatty acids. Moreover, the nature of these antioxidants should not only be lipid soluble (i.e. vitamin E), but both lipid and water-soluble antioxidants, necessary for the intricate system of free radical neutralization. To eradicate the body of a free radical, it has to be transferred from the oxidised lipid (i.e. vitamin E) to a water soluble antioxidant (i.e. vitamin C) that is able to withhold the radical until it is taken out of the body or transferred to a second antioxidant that leads to the excretion of the radical. Many molecules may be involved in this process.

To ensure the antioxidant status of the product, several antioxidants have been included in the formulation of our brain nutrition product.

Choline is essential for the brain

Recently, the choline status of mothers has been investigated, and maternal deficiencies have been found during pregnancy and lactation. During these periods the availability of choline is critical for the development of the brain. Thus far, few studies have focused on this important element, however, we know that choline may be involved in acetylcholine synthesis, transmembrane signal transduction and the regulation of programmed cell death. In addition, choline is essential for a number of brain functions - including memory, mental awareness and the learning processes. Knowing that the maternal storage is depleted during child development has lead us to include choline in our brain nutrition capsule.



In conclusion, these capsules have been formulated to include the most important nutrients for proper brain development and function based upon current knowledge. Our brain nutrition product may be recommended for both maternal and child supplementation, further, new data shows that adults may benefit from the consumption of this product for maintenance of brain tissues.

Selected recent publications:

1. Kretchmer N, Beard JL and Carlson S. The role of nutrition in the development of normal cognition. *Am J Clin Nutr* 1996 Jun; 63(6):997S-1001S
2. Broadhurst CL, Cunnane SC and Crawford MA. Rift Valley lake fish and shellfish provided brain-specific nutrition for early Homo. *Br J Nutr* 1998 Jan; 79(1):3-21
3. Brown JL and Pollitt E. Malnutrition, poverty and intellectual development. *Sci Am* 1996 Feb; 274(2):38-43
4. Odent M. Land food ... sea food ... brain food. *Midwifery Today Childbirth Educ* 1996 Win; (40):18-20
5. Hals J, Ek J, Svalastog AG and Nilsen H. Studies on nutrition in severely neurologically disabled children in an institution. *Acta Paediatr* 1996 Dec; 85(12):1469-75

6. Stoch MB and Smythe PM. Does undernutrition during infancy inhibit brain growth and subsequent intellectual development? *Nutrition* 1996 Jul; 12(7-8):569-71; discussion 568 (Classical article 1963)
7. Crawford MA, Costeloe K, Ghebremeskel K, Phylactos A, Skirvin L and Stacey F. Are deficits of arachidonic and docosahexaenoic acids responsible for the neural and vascular complications of preterm babies? *Am J Clin Nutr* 1997 Oct; 66(4 Suppl):1032S-1041S
8. Crawford MA, Costeloe K, Ghebremeskel K and Phylactos A. The inadequacy of the essential fatty acid content of present preterm feeds. *Eur J Pediatr* 1998 Jan; 157 Suppl 1():S23-7
9. Gordon N. Nutrition and cognitive function. *Brain Dev* 1997 Apr; 19(3):165-70
10. Lanting CI and Boersma ER. Lipids in infant nutrition and their impact on later development. *Curr Opin Lipidol* 1996 Feb; 7(1):43-7
11. Rice R. Fish and healthy pregnancy: more than just a red herring! *Prof Care Mother Child* 1996; 6(6):171-3
12. Zeisel SH. Choline: essential for brain development and function. *Adv Pediatr* 1997; 44():263-95
13. Miller M. Diet and psychological health. *Altern Ther Health Med* 1996 Sep; 2(5):40-8
14. Morley R. The influence of early diet on later development. *J Biosoc Sci* 1996 Oct; 28(4):481-7
15. Koletzko B, Decsi T and Demmelmair H. Arachidonic acid supply and metabolism in human infants born at full term. *Lipids* 1996 Jan; 31(1):79-83
16. McMahon RJ and Cousins RJ. Mammalian zinc transporters. *J Nutr* 1998 Apr; 128(4):667-70
17. Hawkes WC and Hornbostel L. Effects of dietary selenium on mood in healthy men living in a metabolic research unit. *Biol Psychiatry* 1996 Jan; 39(2):121-8