Written by Michelle Gillis (B HSc Naturopathy)

ARE B GROUP VITAMINS A COMMONLY OVERLOOKED FACTOR OF POOR COGNITIVE FUNCTION?

Impaired cognitive function is a common presentation which plagues patients and practitioners alike from time to time. Possible causes or contributing factors of poor memory and cognition include specific nutrient deficiencies, neurotransmitter deficiencies, heavy metal toxicity and cerebral insufficiency.

More commonly used alternative treatments include herbs such as *Ginkgo biloba*, *Rosmarinus officinalis* and *Bacopa monnieri* or nutrients such as omega-3 fatty acids, acetyl-L-carnitine, coenzyme Q10, vitamin E or lipoic acid to name but a few. With all of these valuable nutrients and herbs, it is no wonder we commonly forget to consider and address the patient's B group vitamin status when they present with impaired cognitive function and reduced memory capacity.

There is increasing evidence that even moderately low or sub-clinical B vitamin concentrations may be associated with cognitive impairment. [1]

HOMOCYSTEINE

Homocysteine is an amino acid that becomes elevated in the presence of inadequate folate, vitamin B12, or vitamin B6. A well known risk factor for cardiovascular disease, elevated homocysteine levels have also been shown to be negatively correlated with cognitive dysfunction, and are commonly considered to be an independent risk factor for age related cognitive decline. [1]

There are a number of theories which represent a valid link to elevated homocysteine and poor cognitive function:

- A common hypothesis is that elevated homocysteine levels may be a marker for inadequate systemic vitamin levels, and that decreased efficiency of vitamin-dependent methylation reactions in brain tissue may cause cognitive decline. [2, 3] Low concentrations of folate, vitamin B6 and vitamin B12 may therefore lead directly to cognitive impairment through the accumulation of neuronal DNA damage. [1]
- Another theory poses a concern that the detrimental effects of homocysteine upon the vasculature that contribute to heart disease and stroke, are also likely to increase the risk of vascular dementia and cognitive decline through silent brain infarction. [1, 4]
- Homocysteine may also be directly neurotoxic through the over-stimulation of N-methyl-D-aspartate (NMDA) receptors, which results in calcium influx and apoptosis. [4, 5]

VITAMINS B6, B12, FOLIC ACID AND HOMOCYSTEINE

Much research into homocysteine and cognitive function has focused upon the vitamins B6, B12 and folic acid and how the deficiencies of each may impede homocysteine metabolism. In numerous studies observing elderly patients who suffer with cognitive decline, there are noticeable significant deficiencies of these particular nutrients. [2]

Homocysteine is metabolized via two main pathways:

- **Re-methylation pathway**:
  The re-methylation pathway is a folate dependant reaction which is involved in the conversion of homocysteine to methionine. [2] Both folic acid and cobalamin are required for methionine synthesis and the subsequent formation of S-adenosylmethionine, a universal methyl donor important to the formation of neurotransmitters, phospholipids and myelin. [3]

- **Trans-sulfuration pathway**:
  The trans-sulfuration pathway requires vitamin B6 as an integral cofactor for cystathionine formation from homocysteine and serine. This is then converted to cysteine and glutathione, thereby reducing the potential detrimental effects of homocysteine and increasing combative antioxidant status. [6]

VITAMIN B6

Apart from homocysteine metabolism via the trans-sulfuration pathway, pyridoxine is also required as a cofactor for the synthesis of many neurotransmitters, such as serotonin via its involvement in the enzyme 5-hydroxytryptophan decarboxylase. As such, deficiency states are commonly associated with disturbances of mood and other psychological instability. Dopamine, norepinephrine, gama-aminobutyric acid (GABA) and taurine synthesis also depend upon vitamin B6, and in rat studies, deficiencies of the nutrient have been associated with defects in myelin in the central nervous system. [7]

One placebo controlled double blind study, evaluated the effects of vitamin B6 supplementation in a group of elderly men and found that significant positive effects of pyridoxine supplementation were found in respect to long term memory capacity. [8]

VITAMIN B1

Thiamine is another B vitamin which is reputed to have cognitive enhancing effects. As the vitamin is a water-soluble substance, the body can only store a very small amount, with signs of deficiency developing within 15-18 days of restricted intake. Beriberi is the classic thiamine deficiency state with symptoms such as fatigue, irritability, poor memory, sleep disturbances, anorexia, abdominal discomfort and constipation. [9] Several observational studies have reported that thiamine deficiency is not uncommon, particularly in the older population group. In Alzheimer's disease, a reduced level of plasma thiamine is commonly seen [10] and as a result, high dose vitamin B1 has been the subject of much research with generally positive results.

Thiamine is also involved in the biosynthesis of many cell constituents, including the neurotransmitters GABA and acetylcholine, and therefore plays a role in neurotransmission, nerve conduction and muscle action. [11, 12]

DVPI B COMPLEX

Whether due to low vitamin absorption, utilization, availability or high homocysteine concentrations, B group vitamin intake is an important factor to consider when treating cognitive decline. It is essential that the patient's B vitamin status be assessed when presenting with decreased cognitive function and ability. As this condition is commonly experienced amongst the older population, it is also necessary to consider the possibility of compromised digestive function and hence supplement with a product which is easily assimilated and which contains hypoallergenic and pure ingredients to optimize absorption and utilization, such as the newly released B Complex from Dr Vera's Pure Innovation.

1. Tucker KL, et al., *High homocysteine and low B vitamins predict cognitive decline in ageing men: the Veterans Affairs Normative Ageing Study.* Am J Clin Nutr, 2005. **82**: p. 627-635.
2. Kado DM, et al., *Homocysteine versus the vitamins folate, B6, and B12 as predictors of cognitive function and decline in older high-functioning adults: MacArthur Studies of Successful Ageing.* The American Journal of Medicine, 2005. **118**: p. 161-167.
3. Selhub J, et al., *B vitamins, homocysteine, and neurocognitive function in the elderly.* Am J Clin Nutr, 2000. **71**: p. 614-620.
4. Matsui T., Arai H., and Yuzuriha T. et al, *Elevated plasma homocysteine levels and risk of silent brain infarction in elderly people.* Stroke, 2001. **32**: p. 1116-1119.
5. Ho PI., Collins SC., and Dhitavat S. et al, *Homocysteine potentiates beta-amyloid neurotoxicity: role of oxidative stress.* J Neurochem, 2001. **78**: p. 249-253.
6. Wilcken DE and Wicken B, *B vitamins and homocysteine in cardiovascular disease and ageing.* Ann NY Acad Sci, 1998. **854**: p. 361-70.
7. Riggs KM, et al., *Relationship of vitamin B-12, vitamin B-6, folate and homocysteine to cognitive performance in the Normative Ageing Study.* Am J Clin Nutr, 1996. **63**: p. 306-314.
8. Deijen JB, et al., *Vitamin B6 supplementation in elderly men: effects on mood, memory, performance and mental effort.* Psychopharmacology, 1992. **109**(4): p. 489-496.
9. Braun L and Cohen M, *Herbs and Natural Supplements: An evidence based guide*. 2005, NSW: Elsevier Australia.
10. Molina JA, et al., *Cerebrospinal fluid levels of thiamine in patients with Alzheimer's disease.* J Neuroal Transm, 2002. **109**: p. 1035-1044.
11. Meador K et al, *Evidence for a central cholinergic effect of high dose thiamine.* Ann Neurol, 1993. **34**(5): p. 724-726.
12. Bland J, *Clinical Nutrition: A Functional Approach*. 1999, The Institute for Functional Medicine.